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## NOTES FOR THE MONTH.

In reply to questions in the House of Commons on 2nd March by Mr. MacKenzie Livingstone and Colonel Burton, the Minister of Agriculture and Fisheries, Mr. Edward Wood, made the following statement:—

### **Agricultural Policy.**

“ In view of the refusal of both of the Labour Unions to take part in the proposed conference of agricultural interests, the Government have come to the conclusion that it is impossible to establish a conference on the lines originally suggested. It was proposed by the Government in the hope that, if an agreement between the different sections of the industry could be attained, this might prove the foundation of an agreement between political parties as to a permanent national policy. The refusal of the Labour Unions to participate in the conference has destroyed this hope.

I have carefully considered the possibility of providing representation of farm workers other than from the two unions to which invitations were issued, but apart from the fact that such action would be unlikely to contribute to that political agreement which it was the main purpose of the suggested conference to secure, I am informed that in such an event the Council of the National Farmers' Union would withdraw their representatives.

In these circumstances it will be the duty of the Government, on their own responsibility, to frame such proposals for the assistance of agriculture as are consistent with the necessity of protecting the industry from the danger of sharp reversals of national policy, and with this end in view the Government propose, in accordance with their declared purpose of arriving at the greatest possible measure of agreement, to seek the co-operation of, and invite considered suggestions from the representatives of the different sections of the industry.”

In accordance with the intention announced in the last part of the above statement, the Minister on 6th March addressed



a letter to agricultural associations inviting them to forward considered suggestions, or, alternatively, he suggested that two or three representatives of the associations should be appointed to discuss the question with him.

The associations to whom the invitation has been issued are : The Central Landowners' Association; the Land Union; the Land Agents' Society; the Surveyors' Institution; the Royal Agricultural Society; the Central Chamber of Agriculture; the Workers' Union; the National Union of Agricultural Workers; and the National Farmers' Union.

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THE Ministry has taken over the supervision of the Young Farmers' Club movement, and has appointed an Inspector, who,

### Young Farmers' Clubs.

assisted by the Woman Inspector, will endeavour to organise and co-ordinate the activities of the clubs and to give such supplementary aid as may be sought by local bodies who desire to extend the movement. The Ministry's Divisional Inspectors will also lend their aid to facilitate the provision of lectures and the dissemination of information by local authorities and educational institutions.

Those who are concerned with the furtherance of agricultural education, and who may have opportunities of promoting the establishment of Young Farmers' Clubs in suitable localities, will find helpful suggestions and information in the Ministry's Leaflet No. 103 which has recently been published.

Out of a total of 31 clubs originally promoted, 22 clubs are in active operation (20 in England, 1 in Wales, 1 in Scotland); 6 clubs, temporarily inactive, are being revived. The remaining 3 clubs closed down two years ago, but an endeavour is being made to resuscitate them. The membership totals 332 boys and girls, between the ages of 10 and 18 years.

The following list shows the kind of stock held by clubs :—

Calves	...	10 clubs.	Mixed (Calves, Pigs,	1 club.
Rabbits	...	6 "	Poultry, Bees,	
Poultry	...	5 "	Apple trees)	
Pigs	...	2 "	" (Rabbits and	1 "
Bees	...	2 "	Poultry)	
Horticultural	...	3 "	Ducks	1 "

The clubs have been promoted as follows :—

By Dairy Companies and others	18 clubs.	By Controller of Horticulture	1 club.
" Private individuals	3 "	" Agricultural Gazette	1 "
" Schoolmasters...	3 "	" Schoolmistress	1 "
" Poultry experts	2 "	" Boy Scout Local Association	1 "
		By Breed Society,	1 club.



Most of the clubs have been recently visited, and in every case the keenness and enthusiasm of the members has been very marked. It was felt that a special effort should be made to enlist the sympathy and co-operation of societies interested in educational matters and bring prominently before the public the importance of this movement. Accordingly, the Ministry invited representatives of the Board of Education, the Royal Agricultural Society of England, the National Farmers' Union, the National Federation of Women's Institutes, County Education Authorities, County Agricultural Organisers, the Canadian National Railways and the United Dairies, Limited, to a conference with officers of the Ministry on 27th February. Mr. Dale, Assistant Secretary to the Ministry, presided.

The main features of the proceedings were :—

A brief survey was given of the present position of clubs, with a statement as to the reasons for their success or otherwise. With the exception of one girl who lost her swarm of bees owing to weather conditions, the members of all existing clubs are in a sound financial position. The 14 members of the Sussex Baby Beef Club made a net profit of £240 for the year ending 31st August, 1924. A balance of £50 in Lloyds Bank stands to the credit of 7 members of the Buckland (Buckingham) Mixed Club.

The capital necessary to start a club varies with the stock to be held :—

Approximately	£40 for a mixed club.
Up to	£50—£100 for a Calf or Beef Club.
Up to	£20 for a Bee Club.
„	£20 for a Poultry Club.
„	£25 for a Pig Club.

The Ministry will not make grants or loans to start the clubs, but hopes that promoters will come forward and provide the capital required locally. Clubs ought to be self-supporting at the end of the first year. Hitherto no difficulty has arisen in regard to the question of capital. There will be a central policy directed from the Ministry for the guidance of the clubs, but of sufficient elasticity to meet local conditions. It will be the policy of the Ministry to invite the active co-operation of Local Education Authorities, and the Board of Education is in sympathy with the aims of the movement. The National Farmers' Union and the National Federation of Women's Institutes have both promised to assist. For the provision of technical advice and of occasional lectures it is hoped that the clubs may look to the County Agricultural Staffs and to the Provincial Colleges.



The hearty co-operation of the Boys' and Girls' Club Movement in the Dominions and the United States is assured, and International Cattle Judging Contests have been arranged.

Reference was made to the public-spirited work of companies such as the United Dairies and Milkal Limited, whose directors have done much to promote and foster the movement.

The work of the Ministry will be largely organisation, and interesting local people in the project.

Interest in the Young Farmers' Clubs is rapidly growing throughout the country, judging by the large number of inquiries addressed to the Ministry. No doubt club work will be a prominent feature of the educational system in every county, as it is likely to introduce boys and girls to new or improved agricultural methods at a receptive age and to awaken in them a readiness to test and adopt new ideas. In their time the young people will influence to some extent the outlook, and even the practice, of older people with whom they come into close contact. The movement is almost certain to lead more boys and girls to take advantage of the scheme of agricultural education provided by local authorities through organised courses of instruction or the courses established at Farm Institutes, and, indeed, there is some evidence to show that there have been such results already.

The experience of the United States of America, Canada and New Zealand is that this movement is instrumental in making better citizens, better homes, and in helping to promote and maintain rural life on a sound and economic basis.

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With the growth of the factory system for the manufacture of cheese and other milk products in this country the disposal of dairy sewage presents a grave difficulty.

**Disposal of Dairy Sewage.** In several instances in which the dairy effluent has been discharged into a river or stream there has been pollution, and local authorities have made application to the Ministry of Health for consent to the taking of legal proceedings under the Rivers Pollution Prevention Acts. Moreover, in some instances considerable damage has been caused to sewage disposal works by the discharge of excessive quantities of dairy effluent into the sewers of local authorities, and in other ways such effluent has given rise to a nuisance.



In Holland, where the country is very flat and the waterways are sluggish, the treatment of such waste waters is of vital importance, and in order to investigate the matter thoroughly, as well as to give the factories practical assistance in overcoming their difficulties in this direction, a Government Institute for the Purification of Waste Waters was established by a Royal Decree of 30th July, 1920.

The aim of this Institute is to conduct experimental work at the Institute and at factory installations with the object of preventing the pollution of water. In this way the Institute exercises a direct influence on the prevention of contamination of the waterways, and at the same time is kept fully informed of the difficulties encountered by individual factories.

A report of a deputation—consisting of representatives of the Ministries of Agriculture and Health and the National Association of Creamery Proprietors—which recently visited Holland for the purpose of investigating the methods adopted in that country for overcoming the dairy sewage problem, has been received by the Ministry and describes some of the systems. It shows that in making a comparison between the conditions in Holland as affecting the treatment of dairy wastes with those in this country, it would appear that theoretically the law against pollution is stronger in this country, but in actual practice the results of the administration of the law are much the same in both countries.

Local authorities in Holland generally require that whey, buttermilk or separated milk should not be discharged with the waste waters, and this requirement is generally met.

If whey could be as fully utilised in this country as it is in Holland, there would be no essential difference between the dairy refuse in this country and in Holland, and methods of purification which are applicable there would be applicable here. The discharge of whey along with the dairy effluent is undoubtedly the greatest source of trouble in this country, and if it could be avoided greater advantage could be taken of the natural purification effected by the more rapidly flowing streams of this country. At the present stage of the investigation into this problem, there does not appear to be any system which will deal efficiently for any reasonable period with undiluted whey or separated milk. The best means of dealing with such by-products is the natural one of feeding them to stock on the farm, but how far this can be arranged under the present factory system seems to be a question that has not been investigated up to the present:



The methods in use seen by the deputation are classed as follows: (1) dilution; (2) land treatment or irrigation; (3) lime precipitation followed by septic tanks and percolating filters; (4) activated sludge process.

Dilution was not generally found to be effective, even in the case of large canals, for although they are of large volume, they are almost stagnant and so do not afford sufficient dilution to be effective. Land treatment is only effective where a large area of suitable sandy soil is available. Percolating filters are effective if proper attention is given to their construction and management.

The activated sludge process was only being investigated on a laboratory scale at the date of the visit, and therefore could not be classed as one of the systems in actual practice. It is, however, understood that subsequent working scale experiments have been put into operation, and that they are very promising. It is to be hoped that the results of these experiments will be forthcoming at a later date.

It would appear that if any systematic investigation of this problem is to be undertaken in this country, it can only be done effectively by the establishment of an Institution on the lines of the Government Institute for the Purification of Waste Waters already established in Holland. This is a very vital question for the dairy and other industries in this country, and no effort should be spared in endeavouring to solve the problems which it presents.

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THE Departmental Committee appointed by the Minister in February, 1924, and consisting of the Rt. Hon. E. G. Pretyman (Chairman), Sir W. Bromley-Davenport, K.C.B., and Messrs. A. Batchelor, H. German, and W. R. Smith, which inquired into the circumstances of the serious outbreak of foot-and-mouth disease which occurred during 1923 and 1924, has now issued its Report.\*

The Report, which is signed by all the members, traces the causes which led to the extraordinary development of the disease, with special reference to the circumstances attaching to the introduction and spread of disease in Cheshire.

It contains a number of important conclusions and recommendations with regard to the policy of the Ministry in dealing with outbreaks of the disease; the manner in which that policy

\* Cmd. 2350, to be obtained either direct from H.M. Stationery Office, price 1s. 6d., or through a bookseller.



has been carried out by the Ministry and Local Authorities; precautions against the introduction and spread of the disease; compensation for slaughter; restrictions on the movement of animals and persons; and insurance, both compulsory and voluntary.

The Report cannot fail to be of interest to all who are in any way connected with the administration of the Diseases of Animals Acts, whether as members or officials of Local Authorities, or as stock owners.

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THE decline in horse breeding, as shown in the Agricultural Returns last June, when the number of stallions used for service

**Licensing of  
Stallions in  
Season 1925.**

was returned as 4,707 as compared with 5,459 in 1923, and the number of foals as 54,801 as compared with 66,323 in the previous year, is further emphasised by the records available to 21st March as to the number of stallions licensed by the Ministry for this season under the Horse Breeding Act, 1918.

While some further applications for licences may be received during the next three months the number issued to 21st March is only 1,414. The comparative figures at this date for the last three service seasons are 2,808 in 1922; 2,217 in 1923; and 1,664 in 1924.

After the close of the service season the Ministry will publish particulars, according to breeds, of the total number of licences issued, but the information so far available may be of interest to horse breeders :—

<i>Service Season.</i>	<i>No. of licences issued to 21st March.</i>			
	<i>1922.</i>	<i>1923.</i>	<i>1924.</i>	<i>1925.</i>
Shires ... ..	1,774	1,349	902	741
Other Heavy Horses ...	520	405	336	274
Light Stallions (including Ponies) ... ..	514	463	426	399
Total ... ..	<u>2,808</u>	<u>2,217</u>	<u>1,664</u>	<u>1,414</u>

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THE process invented by Dr. de Vecchis for the manufacture of beet sugar was brought to the notice of the Ministry in 1924. The process employs the principle of desiccation, and the economies which might result in the manufacture of sugar were obvious if the claims made on behalf of the process could be sustained.

**The  
"De Vecchis"  
Beet Sugar  
Process.**

The reports which came to the Ministry from various sources were, however, conflicting, and in order to obtain an authoritative and independent opinion a Commission of Inquiry was appointed and sent to Italy. The Commissioners were Mr. John Bowden, M.I.C.E., M.I.Mech.E., late Chief Superintendent of H.M. Ordnance Factories, Woolwich Arsenal; Dr. William Goodwin, Advisory Chemist, South-Eastern Agricultural College, Wye; and Dr. B. J. Owen, Director of the Institute of Agricultural Engineering, Oxford. The Report of the Commission, of which the following paragraphs are a summary, has now been published.\*

The industrial extraction of sugar from beet is most generally effected by the diffusion process, in which fresh beets after washing are sliced into cossettes and treated in suitable vessels with warm water, in volume sufficient to bring about the diffusion of the saccharine juice contained in the beet cells. This juice is afterwards purified and filtered. The resulting clear thin juice is concentrated by evaporation until sugar crystals form. Molasses are separated from the raw sugar crystals by centrifugal action, the sugar is refined and put up into marketable form, and the molasses are either sold as such or subjected to a further process by which other products are extracted.

In the De Vecchis process the fresh beets are washed, sliced into cossettes and desiccated in a drying apparatus in which the moisture of the fresh beet is reduced from 80 per cent. to 3 per cent.; desiccation is continued until the membrane of the sugar-containing cells is ruptured, and the albuminoid and pectic matter coagulated. The cossettes, as they leave the drier, are rigid and horny and have about 25 per cent. of the weight of fresh beet. In this condition they can be kept in suitable store rooms for several months without fermentation or loss of sugar. The sugar is extracted from the dry cossettes by washing with warm water. This process produces a juice

\* Cmd. 2343, to be obtained from H. M. Stationery Office or through any bookseller, price 9d.



high in sugar content and free from the flocculent albuminoid and pectic matter. Without further treatment by evaporation, the juice (as in the diffusion process) is boiled and cooled, and the raw sugar separated from the molasses. The refining of the raw sugar into white sugar suitable for the market, and the treatment or disposal of molasses follow on the same lines as in the diffusion process.

Raw sugar was produced at the Loreo factory during the visit of the Commission, although the plant has not yet reached a stage of regular operation, mainly owing to the unsatisfactory desiccating apparatus employed. The conditions are as yet too unstable for the cost to be verified. The possibilities of the De Vecchis process were amply demonstrated, and after careful consideration of the plant and conditions at Loreo the Commission came to the conclusion that if worked with modern machinery the cost of producing sugar by this process would be no more, and probably less, than by the diffusion process.

The process has scarcely yet emerged from the experimental stage, but the principles appear to be sound and the improvements in the plant necessary to render it commercially successful ought to present little difficulty. Once these difficulties are overcome the process would present very great possibilities for the development of the sugar beet industry in this country. Conditions in England may differ in certain details from those in Italy, and the costs of production claimed for the De Vecchis process would need to be verified in actual operation here before any encouragement were given to its adoption by the sugar beet interests in this country. The process appears to be suitable to districts where the acreage under beet is small and widely scattered, and from which the annual production would be insufficient or the distance for transport too great to justify the outlay on a diffusion factory. It should, therefore, appeal to co-operative societies of small growers or to local trading groups. There is, however, reason to believe that the system could be made to apply to large scale production, since the desiccated cossettes can be treated by the equipment common to a diffusion factory. This offers the advantage of employing the factory for a greater part of the year than is now possible. The practice of desiccating beets suggests the possibility of installing drying plants suitable for small groups of farmers by means of which beet could be dried before transport to the factory.



The Commission came to the conclusion that while the principles of the De Vecchis system were technically sound, the question of their practical application was an open one, and that until reliable costings of the De Vecchis process, working on a satisfactory industrial basis, are available, it is not possible to say whether the claims made for the system would be realisable in practice. The Commission, however, thought the system sufficiently promising to justify further experimental work, and they made the following recommendations:--

(1) A complete plant of small capacity, but on a factory basis, should be set up in England by which the De Vecchis process may be tested experimentally. The experimental plant should incorporate such improvements as to secure efficient desiccation and defecation.

(2) Experiments should be undertaken to devise a complete cleaning, slicing and desiccating equipment of a capacity suitable for operation by the beet grower.

The question of carrying out experimental work on the lines suggested by the Commission is receiving the consideration of the Ministry, and a public announcement will be made when a decision is reached.

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In the report on the working of the Seeds Act, 1920, during the 1922-23 season which appeared in this *Journal* in December,

**The Sale of  
"Red Clover."** 1923 (pp. 822-829) reference was made to the undesirable but very prevalent practice of selling Red Clover under a multiplicity of names such as "Red Clover," "Cowgrass," "Single Cut Cowgrass," "Perennial Red," "Giant Hybrid Cowgrass," "Late Flowering Red," "Common Red," "Broad-leaved Red," etc. This point is further developed by Professor R. G. Stapledon in his article, "Nomenclature of Grasses and Clovers," which appeared in this *Journal* in May, 1924 (pp. 156-161). It is therefore interesting to note in the new season's catalogues of some of the leading seed merchants announcements that they intend in future to describe their red clovers under the early-flowering and late-flowering groups, and to discontinue the use of such terms as "English Cowgrass," "Giant Cowgrass," "Mammoth Cowgrass," etc. This is a move in the right direction, and it is hoped that it will be followed by all the seedsmen in the country. It cannot be too frequently emphasised that there are only two groups of cultivated red clovers: one, which it is suggested should be described simply as "Broad Red Clover," being the



kind favoured for its production of spring and winter growth, of short-lived duration and most suitable for use in short leys; and the other, which should be known simply as "Late-flowering Red Clover," a more persistent variety and therefore most useful for long duration leys or for permanent pastures. It is true that there are numerous types in both of these groups. For instance, there is the "Montgomery Red" and the "Cornish Marl," both having extra lateness and persistency as a characteristic, but these are natural selections of the late-flowering group and should be described as such, although in two such special types as these, it might be desirable to add the more specific names in brackets, for the guidance of those who particularly need an extra-late-flowering clover.

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THE Minister of Agriculture and Fisheries appointed, early in March, a Committee to inquire into the conditions of the export trade in horses from Great Britain to the Continent, and to advise whether, having regard to the necessity of ascertaining that no avoidable suffering is inflicted on such horses, any further restrictions should be imposed on the trade.

#### **Export Trade in Horses.**

The Committee is composed as follows: Major J. W. Hills (Chairman); Sir Merrik Burrell, Bart., C.B.E.; the Lady Emmott, J.P.; the Marquess of Titchfield, M.P.; the Earl of Haddington, M.C.; the Hon. E. A. St. Aubyn Harney, M.P.; Arthur Hayday, Esq., M.P.; Major F. T. G. Hobday, C.M.G., F.R.C.V.S.; Mr. H. H. Miller, of the Ministry of Agriculture and Fisheries, is Secretary of the Committee.

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THE duty imposed upon the Agricultural Wages Committees of fixing minimum rates of wages for all classes of workers

#### **Farm Workers' Wages.**

employed in agriculture has now been completed so far as male workers are concerned, by the making of the necessary Orders by the Agricultural Wages Board to cover such workers in all areas. Particulars of the Orders made since the March issue of the *Journal*, are given on p. 86. This marks a definite stage in the work of the Committees and, inasmuch as it has not been necessary for the Agricultural Wages Board to fix any rates in default of the Committees reflects great credit not only upon the wisdom and tact of the Chairmen and impartial members of the Committees, but upon the conciliatory manner in which the members



representing employers and workers have dealt with very controversial questions.

A point of particular interest to the farmer is as to how far the rates now operative are stable rates upon which he may budget for the coming six or twelve months. The date of termination of the rates in each area has been given in the *Journal* as each Order has been made, but it is instructive at this stage to see the general trend of the Agricultural Wages Committees' decisions in this matter. In six areas the rates now fixed will operate for twelve months, and in six others no date of termination has been fixed. The most general period is until September or October next, and this has been adopted by 17 Committees. In three areas the present rates will expire in November; in two in December, and in one in January, 1926, the remaining areas being covered by short period Orders which will need to be replaced by fresh Orders at a fairly early date. Thus it will be seen that in 35 of the 47 Agricultural Wages Committee areas minimum rates for the whole of the coming summer are now in operation.

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THE Ministry has addressed to Town Clerks and Clerks to County Councils an inquiry as to what customary markets, fairs,

**National Survey  
of Markets.**

wool auctions, or other periodical assemblies of buyers and sellers of agricultural produce are held in England and Wales. Preliminary information is requested on the following points:—

- (a) The names and location of the markets held in the area concerned :
- (b) the type of market in each case, i.e., whether controlled by a local authority or privately ; whether and, if so, to what extent wholesale or retail, and how often held ; and
- (c) to whom communications in regard to the markets referred to in (a) should be addressed.

This inquiry arises from the following recommendation contained in paragraph 100 of the Final Report of the Departmental Committee (known as the Linlithgow Committee) on the Distribution and Prices of Agricultural Produce (Cmd. 2008) :—

“ During the course of our inquiry, we have been struck by the lack of readily available information regarding the markets of the country. . . . As a preliminary step to the further consideration of this question, we think it desirable that the Government Departments concerned shall collect and publish information as to the control and ownership of markets, and any relative information likely to be useful.”



## THE IMPROVEMENT OF VERY POOR PASTURES BY PLOUGHING AND IMMEDIATE RE-SEEDING.

PROFESSOR R. G. STAPLEDON, M.B.E., M.A.,  
*Welsh Plant Breeding Station, Aberystwyth.*

THE Welsh Plant Breeding Station has an experimental farm of about ninety-six acres, the greater part of which is devoted to small scale plot trials. On this farm grazing has to be found for four working horses during the summer, and all the year round for a flock of sheep, upon which to draw for experimental grazing on plots devoted to various purposes. In order to ensure the provision of maximum grazing from fields unsuitable for critical field experiments it was therefore decided soon after taking possession of the farm to make every endeavour to convert all such fields which were in permanent grass or in out-run leys into high-grade temporary grass, the ultimate aim being to have on the farm no single field in permanent grass or under a ley of poor quality.\*

It has been sought as far as possible to give an experimental character to the work of conversion; the sowing out has always been done on a plot basis and careful records have been kept of the cultural operations, and of the nature of the swards achieved, while early last year a system was initiated of registering the grazing from all the separate enclosures on the farm in terms of "sheep days."

In the main the plan adopted has been to plough the old sward and sow a seeds mixture almost immediately, either under a first and only corn crop, under rape, or without a nurse crop, and generally the large numbers of farmers visiting the station have been more struck by the palpable excellence of these swards, and, to them, the incredibly short time in which they have been established, than by any other aspect of the work in progress at the station. It is proposed in this article to give fairly complete particulars with reference to one of the most interesting fields, since it is felt that this information will be of value, not only to those who occupy farms in Wales that consist predominantly of inferior grass land, but also to graziers in general who are faced with the problem of how to improve fields of almost negligible grazing value in the shortest possible time.

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\* Areas obviously too water logged or too heavy to allow of even occasional ploughing, and those also which are too shallow and too steep for the plough, are regarded, and not without reason, as being unworthy of remaining in grass and are being planted with Sitka spruce and larch respectively.



**The Field.**—The experiment to be described was conducted in the Spring Field, a field with a north-easterly aspect, and on a very steep gradient, but not too steep, it was thought, to justify occasional ploughing. The soil was decidedly shallow, light and stony. The field had evidently been under the plough at some period in the past, since the marks of the open furrows were unmistakable. It is known, however, that the field had been under grass since 1909, and had received no treatment, manurial or otherwise, since that date, and such evidence as is available renders it highly probable that it was let down to grass upwards of twenty years ago. Botanical analyses were made on some of the very best portions of the sward during February, 1923.\* The composition of the herbage on these relatively “good” portions was as follows:—

	per cent.
Bent ( <i>Agrostis vulgaris</i> ) ... ..	58
Crested Dog's Tail ... ..	11
Yorkshire Fog and Sweet Vernal Grass ...	10
White Clover ... ..	6
Woodrush ( <i>Luzula</i> spp.) ... ..	4
Twenty other species, representing five species of grasses, one legume, and fourteen miscellaneous herbs ... ..	11
	<hr/> 100 <hr/>

In this condition the field was of negligible grazing value and was considered little, if any, better than mountain grazing. It was difficult to keep a flock of sheep on the field for more than three or four days at a time, even during the height of the growing season, while during March and April it was always necessary to supplement the meagre grazing with hay. “Sheep day” evidence subsequently obtained on another field with a slightly better herbage shows on a conservative estimate, that the field under review would have hardly come up to Pryse Howell's estimate, based on a survey of a number of farms at an average elevation of 600 ft. above sea level, with a carrying capacity of 1.1 Welsh Mountain sheep per acre.†

**Cultivation Operations Previous to and at the Time of Sowing.**—It was desired to ascertain whether the field could be successfully resown without very careful and deep ploughing—consequently, and with a view to expediting the work, it was tractor ploughed (one way) early in April, 1923. On the

\* Twenty-six turves 6 in. x 6 in. were taken from carefully selected squares and these were analysed by the “percentage frequency” method by students as part of their practical work.

† Pryse Howell, J.: “The Productivity of Hill Farming,” Oxford Institute for Research in Agricultural Economics, 1922.



basis of Cardiganshire war experiences with the tractor this would have been voted by most local farmers as an impossibility! It was necessary to leave wide headlands and these were horse ploughed. The contrast between the two methods of ploughing was very considerable—the body of the field under the tractor was very poorly ploughed—much too shallow, and the old turf was not properly buried. On the headlands the turf was completely buried under an adequate depth of soil. Harrowing was started early in May, and it was found impossible to break the soil down properly to anything approaching a reasonable depth (except on the headlands), chiefly owing to the fact that the top four inches of soil consisted almost entirely of a dense mass of roots. The final tilth was prepared by 18th May, on which date the experimental mixtures were sown. The average depth of the seed bed on the tractor area was about half an inch only and probably nowhere exceeded one inch. The seeds were sown on a dry day, covered with the chain harrow and rolled. Owing to the steepness of the field the rolling was, however, quite inadequate.

It will be apparent that the above conditions were far short of what ideally should have been aimed at for the purpose in view, and indeed the only conditions that were reasonably favourable for the establishment of the seeds were, first, that the soil was dry when the seeds were sown, and secondly, that subsequently showery weather intervened. It had been intended to apply basic slag at the time of sowing, but, owing to other pressing calls on the time of the men, this proved to be impossible. A dressing at a rate equivalent to 7 cwt. per acre of high-grade slag was, however, applied to the established sward in the second week of September, 1923.

**Experimental Mixtures.**—The field was divided into two approximately similar areas of about  $1\frac{1}{2}$  acres each, the areas being respectively sown with the mixtures shown below:—

				<i>Area A.</i>	<i>Area B.</i>
				lb. per acre.	lb. per acre.
Rape	...	...	...	3	3
Italian Rye Grass	...	...	...	6	6
Indigenous Cocksfoot	...	...	...	13.5	—
Commercial Cocksfoot	...	...	...	—	13.5
Indigenous Tall Oat Grass	.	.	.	3.5	—
Commercial Tall Oat Grass	...	...	...	—	3.5
Indigenous Tall Fescue	...	...	...	2.2	—
Commercial Tall Fescue	...	...	...	—	1.4
Montgomery Late Red Clover	...	...	...	4.5	—
Chilian Early Red Clover	...	...	...	—	4.5
Wild White Clover	...	...	...	1.0	—
White Dutch Clover	...	...	...	—	1.0



**Early Establishment.**—The difference between the horse-ploughed headlands and the body of the field (tractor area) was very striking as soon as the seeds began to braird, and indeed can still be seen (practically two years afterwards). On the body of the field, on which it must be insisted that the seeds were obviously not covered properly, the only species to establish itself really well was Italian rye grass—the red and white clovers established themselves only fairly satisfactorily, and the two cocksfoots eventually (although very slowly) established themselves in moderate quantity, although in a manner quite disproportionate to the amount of seed sown. Both the tall fescues were to all intents and purposes a complete failure. The tall oat grasses established themselves poorly, but appreciably, having regard to the smallness of the sowing of this large seeded species. The rape took but poorly and was disappointing throughout; no doubt this round seed, even more than the clovers, must be properly anchored to the ground in order that the seedlings may establish themselves.\*

The above facts add emphasis to the absolute necessity of covering small seeds properly—a point which was convincingly demonstrated by Speir† some years ago, and quite recently by Williams. The evidence also suggests the futility of including in a seeds mixture, for sowing on poor land and on a poor tilth, species other than those known to have reasonably good powers of establishment, while even in the case of the species most likely to succeed, the desirability of adding to the seed rate in proportion to the poorness of the conditions is strikingly indicated.‡

\* Trials on other areas have, however, clearly indicated that rape is unlikely to succeed particularly well unless the soil is in a fertile condition or unless manures have been freely applied.

† See Speir, John: "Depth at which grass seeds should be sown," *Trans. High. and Agric. Soc. of Scotland*, 5th Ser., Vol. V, 1895, p. 11. See R. D. Williams: "Depth of Sowing Grass and Clover Seeds," this *Journal*, Apr., 1922, p. 53, and May, 1922, p. 132; and "Methods of Covering Grass and Clover Seeds," *ibid.* March, 1923, p. 1125, and March, 1924, p. 1134. It is of interest to remark that although Capt. Williams was unaware of Speir's investigations at the time of conducting his own trials, nevertheless both authors in effect make the same recommendations, namely, "sow when the soil is dry, sow on a harrowed surface, cover with a peg harrow and roll well" as the final operation."

‡ See Stapledon, R. G., and Jones, Rhoda: "Seed Mixtures for Temporary Grass: Investigations Conducted in Denmark and Sweden and Observations on Trials of a Similar Nature in Progress at Aberystwyth," *Welsh Journal of Agriculture*, Volume I, No. 1, page 60.

It is interesting to note that the behaviour of the species as indicated above coincides pretty closely with what would have been expected on the basis of both the Scandinavian investigations and critical trials now in progress at the



**The Grazing Value of the New Swards.**—In estimating the grazing value of the newly established swards, it is necessary to do so in relation to the following periods:—

- (1) Late summer and autumn of the seeding year (1923).
- (2) January, February, March and April of first harvest year (1924).
- (3) May and April of first harvest year (1924).
- (4) July and August     "     "     "     "
- (5) September and October     "     "     "
- (6) November and December     "     "     "

The two areas A and B were fenced separately, the original intention being to graze both plots uniformly during the first autumn and to obtain live weight increase data throughout the first harvest year. It was subsequently found impracticable to make the necessary sheep weighings, while the size of the plots was considered inadequate, and it was, therefore, decided to keep records in terms of "sheep days"; unfortunately, however, the sheep register was not started until January, 1924. During the whole of the first harvest year (1924) the plots were grazed with a control flock of Kerry Hill and Suffolk ewes (with or without their lambs according to season). The average weight of the ewes may be taken as about 130 lb. The plan adopted was to graze on an intermittent basis, putting a relatively large head of sheep on the plots (usually about 13-25) until they had practically cleared the herbage available and then resting the swards until the growth was sufficient to justify a further spell of hard grazing.\*

**Autumn of the Seeding Year.**—Sheep were turned on the plots for the first time on 25th August, 1923, that is to say, a field of negligible grazing value had only been put out of action

Welsh Station. The outstanding ability of Italian Rye grass, and of Perennial Rye grass also, to establish themselves under unfavourable conditions, is undoubtedly one of the reasons and perhaps the chief reason—and a largely unsuspected reason—why the hill farmer and others operating on poor land adhere so tenaciously to large sowings of these grasses.

\* It is beyond the scope of the present paper to discuss in detail the general applicability of this method of comparing the value of one sward with another, and it is obviously open to criticism from many points of view. It is a method, however, the ramifications of which it is intended to explore fully, and it is hoped to collect data which will make it possible to form a critical judgment alike as to its limitations and as to the uses to which it can legitimately be put—and looked at solely from this point of view the data presented in this paper are not without interest.

The following scale has been adopted with regard to converting lambs into sheep: For lambs dropped between March 10th and April 10th, one lamb equals, for the various grazing periods, the following fractions of a sheep:—May 1st-10th,  $\frac{1}{16}$ th; May 11th-20th,  $\frac{1}{5}$ th; May 21st-31st,  $\frac{1}{4}$ th; June 1st-10th,  $\frac{1}{3}$ rd; June 11th-20th,  $\frac{1}{3}$ rd; June 21st-30th,  $\frac{1}{2}$ ; July 1st-10th,  $\frac{1}{2}$ ; July 11th-20th,  $\frac{1}{2}$ ; July 21st-31st,  $\frac{2}{3}$ ; August 1st-31st,  $\frac{2}{3}$ ; September 1st to December 31st,  $\frac{3}{4}$ . Owing to the shortage of grazing on the farm, horses had occasionally to be put on the plots, the conversion then used was—one horse grazing for 24 hours = 7 sheep, and grazing for a night only = 4 sheep

for a period of about three months, at least six weeks of that period being at a time of the year when the farmer normally has available almost more pasturage than he knows what to do with.

From the grazing point of view, the only species contributing to the herbage in appreciable amount during the autumnal period were the Italian rye grass, the rape (although a poor crop) and the red clover, and considering the smallness of the sowing the sward developed by the Italian rye grass in particular was at this time the outstanding feature of the field. The difference between the two plots was not very great, except for the fact that the Chilian red clover made more growth than the Montgomery. As the former would have contributed more keep than the Montgomery during the first autumn, it was in a sense more heavily grazed than the Montgomery during this period.

Unfortunately "sheep day" records were not kept during this period, but the ley provided an abundance of grazing until early November. Results from another experiment reported elsewhere give a measure of the achievement of Italian rye grass and red clover from 14th August to 31st October, showing an average carrying capacity of six mountain sheep per acre, making satisfactory live weight increases.\* The ley under consideration was advisedly not grazed to its full capacity during the first autumn, but on a conservative estimate it probably carried approximately three of the Kerry Hill ewes per acre and could have been made to carry more.†

**First Harvest Year.**—*Botanical Evidence.*—Practically the only species contributing in really appreciable amount to the pasturage during the period January to April was Italian rye grass, and thus the grazing on the two plots was of precisely the same order. During May and June cocksfoot began to give a quite definite character to the herbage, but since botanical analyses showed that the indigenous and commercial

\* See Williams, R. D., "Winter Keep": *Welsh Journal of Agriculture*, Vol. I, 1924, p. 119.

† Perhaps an even better example of a field dealt with in the manner under review is afforded by a four acre field standing at about 900 feet above sea level at Blaentwrch, Farmers, Carmarthenshire. The field, which was steep, had not been under the plough for 35 years and was carrying a sward of negligible value. It took 15 days to plough the field, which was sown out on 17th June, 1924, with 10 lb. Italian rye grass and 8 lb. rape; 6 cwt. of 38 per cent. basic slag to the acre were applied on 28th May and 1 cwt. nitrate of soda on 18th July. Grazing commenced on 17th September, and from this date to 6th November, forty Welsh wether lambs were fattened. They were sold off at 34s. per head, their value being estimated at 24s. per head when turned on to the field. The field has maintained twenty-five store ewe lambs from 6th November last to 17th February, 1925.



strains were about equally distributed on their respective plots, it is not probable—particularly since Italian rye grass was still by far the most abundant grass—that the grazing of the plots was differentially affected by the fact that cocksfoot was represented by a different strain in each. By June, the plots showed a very decided difference in respect of the clovers. In the case of white clover, although the number of plants per unit of area was about the same for both white Dutch and wild white, the plot on which wild white had been sown showed a much denser and closer mat of white clover and had the appearance of providing actually the greater amount of herbage.

The greatest contrast was, however, between the red clovers, and this became considerably accentuated in July and August, during which period the Italian rye grass began to wane and the red clover for the first time became the dominating element in the grazing. The Montgomery plot was then manifestly throwing more red clover than that on which Chilian had been included. By September the wild white clover had fairly established itself and during this month both the white clover (particularly wild white clover), and red clover (particularly Montgomery) continued to provide probably the largest proportion of the grazing. In October and early November, Italian rye grass was again the chief element in the herbage, assisted to some extent by the clovers, cocksfoot, and such grasses as the fine leaved fescues and bent, which had come in again to a slight extent. By December daisies, ribgrass and cat's ear, also present in appreciable amount, were similarly contributing to the grazing taken by sheep.

Notes taken in February, 1925, that is to say, early in the second harvest year, showed Italian rye grass, although much thinned, still remarkably abundant on the plots, and still capable of growing quickly after grazing and once again contributing far more keep at this period than any other species. The wild white clover was well established and with very appreciable assistance from the Montgomery red and the cocksfoot it was quite evident that a sward infinitely superior to the original turf was assured for at least another three or four years, and probably for a considerably longer period. The plot on which white Dutch and Chilian red replaced wild white and Montgomery red does not look so promising, but it is apparent that on this plot a considerable amount of native and non-sown wild white has re-established itself, and it is

quite evident that it will take some years before the herbage even on this plot can revert to its original inferior character.

It is probable that the plot on which the wild white clover and Montgomery red were included was very slightly more favourably placed than the other. It was, however, noted at the time that Chilian red clover established itself quite as well as, and probably slightly better than the Montgomery: yet by October, 1924 (first harvest year), careful counts showed that there were over eight times as many plants of red clover per unit of area on the Montgomery red plot as on the Chilian red plot.\* On sub-plots which had been grazed till March and then put up to hay the advantage was still with the Montgomery red, but on these hay plots the red clover was only three times as plentiful on the Montgomery as on the Chilian plots. The above facts, even if greatly exaggerated by soil differences,† afford striking confirmation of results obtained on small-scale plots repeatedly cut with a garden mowing machine, namely, that the extra late flowering red clovers stand heavy grazing altogether better than the early reds. Thus continued intermittent grazing from the moment of establishment of the ley had shown its effect to a far greater extent on the Chilian than on Montgomery red clover, and this effect still showed itself, although to a less degree, when heavy grazing was operative only during the first autumn and up to March of the first harvest year.

“*Sheep Day*” Evidence.—It will have been apparent from the above botanical description that the effective herbage on the two plots did not differ materially, except during late June, July and August, when the preponderance of red clover on the Montgomery plot undoubtedly had a considerable influence. In view of this, and the fact previously mentioned, that the two plots were apparently not quite equally placed as to soil, the “*sheep day*” results for the two plots have been averaged and give the carrying capacity of the ley as a whole (a three acre field), for the period 1st January to 31st December, 1924 (= the whole of the harvest year), as 2.9 adult—and for the district decidedly heavy—sheep per acre, compared to the previous capacity of the field which was certainly not more than 1.1 mountain sheep (of an average weight not exceeding 65 lb.) per acre.

\* Based on eight readings (with a mesh 6 in. x 6 in.) on each of three representative squares.

† If the differences above noted had been solely due to soil irregularity, it would have been expected that the ratio of Montgomery to Chilian on the hay and pasture plots alike would have been about the same.



The average figures for the five periods in terms of sheep per acre were as follows:—

January-April	...	...	...	0.9
May and June	...	...	...	4.9
July and August	...	...	...	6.7
September and October	...	...	...	1.3
November and December	...	...	...	0.8

The above figures afford a striking commentary on the value of clovers, perhaps especially red clover, for summer grazing—the field actually attaining to its highest carrying capacity in July and August, a period when, ordinarily, grazing is not so plentiful as in May and June. The figures also indicate the great difficulties connected with providing herbaceous keep during the winter and early spring months. The better part of a large sheep to the acre maintained in health and without any hand feeding has, unfortunately, by comparison with the ordinary grass land of the district, to be regarded as eminently satisfactory. It should be emphasised that the “sheep days” recorded during the dead season on the ley were not “starvation” days. It was always noted that sheep turned on this or other rye grass areas were contented (of course only for a reasonable grazing period) and did not attempt to break fence, nor had they access to any appreciable area of hedge. On the ordinary permanent grass of the district it is quite impossible to retain sheep for more than a few hours at a time on a small enclosure during the winter, while the contribution made by hedges to the starvation ration afforded by such pastures must be very considerable.

**General Conclusions and Recommendations.**—From the particulars given as to the establishment of the seedlings it is obvious that when it is proposed to plough down a sward and immediately re-sow it with a view to producing an improved pasture, the ploughing should be deep and the turf completely buried, and every endeavour should be made to obtain a tilth of at least 2 in. in order to render it possible to cover the seeds properly. The question of the correct date for ploughing and also for sowing out is therefore important. It would in most cases be an advantage to plough earlier than April so that the old turf could be given more time to rot and the upturned soil more time to become weathered by natural processes. Within reason too the earlier the sowing out the better, so that the sown species may be given the longest possible time to establish themselves before a certain inevitable growth is made

by the old turf.\* The practical objection to an earlier start is, of course, that under present systems of management every yard of winter grazing, no matter how intrinsically inferior, is regarded as of the greatest possible value.

Evidence from other trials very similar to the one here discussed lead to the almost irresistible conclusion that perhaps the chief factor making for the success of the undertaking is to apply basic slag in adequate amount, *just previous to, or at, the time of sowing*. On poor land there seems to be little doubt that slag incorporated properly in the soil does assist the seeds to establish themselves and hastens the formation of a sward to the sward more effectually than does an equally heavy dressing applied on the surface *after the seeds have taken*.

The last points to be insisted upon in connection with cultural operations (again drawing evidence from a number of trials) are, the desirability of sowing on a harrowed surface, of harrowing the seeds in with a peg-toothed harrow, and the importance of concluding with heavy rolling. Thus a dry soil and dry weather at the time of sowing are alike important.

It is evident, however, from the results given by the trial under review, that if conditions only sufficiently satisfactory to ensure a reasonable take of Italian rye grass, and but a moderate take of wild white clover.† can be achieved there is yet every prospect that a sward incomparably superior to the old turf will be produced in the course of but a few months.

The Italian rye grass may apparently be relied upon to provide good grazing until the wild white clover has fairly established itself, and until an improved semi-natural sward develops under the ameliorating influence of wild white clover.

It is not suggested that mixtures for this purpose should consist only of Italian rye grass and wild white clover, but it is suggested that such a mixture would be far more likely to be reasonably successful than a complete failure. It is further suggested that Italian rye grass and wild white clover should be regarded as the pivotal species around which all such mixtures should be drawn up, and particularly when due regard is paid to two further facts, namely, that Italian rye grass and wild white clover in their two very different ways are pre-eminent as suppressors of weeds—a very important matter when one sets out to conquer an old turf full of weeds—and that Italian rye

\* It might be thought that the autumn would be a favourable season to undertake the work of conversion: trials now in progress at the station show conclusively that in West Wales, at all events, the sowing of small seeds even in August is attended with considerable risk, while to sow later is to court almost certain disaster.

† For under the combined influence of slag and abundance of bare ground wild white clover will rapidly compensate itself for an indifferent take.



grass is of outstanding value for providing winter and early spring keep.

Modifications in the mixture should first aim at putting the field out of action for as short a time as possible, and also assisting to provide winter keep. Thus there is much justice in Wibberley's\* suggestion, although made in a somewhat different connection, that mustard and hardy green turnips might be introduced to replace the rape.

Further modifications should aim at providing as much keep as possible during the first harvest year, particularly when the Italian rye grass begins to wane, and the experiment under review has shown clearly that an extra late flowering red clover is superior to an early or broad red clover for this purpose, and this is substantiated by all the small scale trials bearing on the subject that have been so far conducted at the station. These have incidentally shown that of the earlies a good English strain is far superior to Chilian.†

Having regard to the cost of ploughing and other necessary cultivations the most important modifications to be made in the mixture must aim at assisting the wild white clover to form rapidly the counterpart of an excellent permanent sward that will continue productive for a considerable number of years.

Had the field under review been horse ploughed it could only have been ploughed one way, and one-third of an acre a day would have represented good work—thus it is doubtful if such a field could have been re-seeded with a reasonable mixture and adequately slagged under £6 per acre. The costs would of course be considerably reduced on less difficult fields; while in regard to all work of this sort it must always be remembered that the ploughing of old sward can be undertaken under weather conditions when normally horses would be idle and men would be performing bad weather jobs. Thus, in many cases it might with much justice be argued that the cost of ploughing would, in fact, be adequately met by a debit to cover a few ploughshares, insurance against employers' liability, and the whole or a part of the horseman's wage, according as to how economically he would otherwise have been employed.

Looked at from every point of view, however, it will be apparent that it will probably but seldom pay to break and re-sow a turf unless at least four, five or more years of greatly increased grazing can be assured—although in estimating the number of

\* See "Spring and Summer Forage Crops" in *The Book of Dunns' Farm Seeds*, Salisbury, 1925.

† See e.g. R. D. Williams: "The Productivity of Different Strains and Nationalities of Red Clover under Hay and Pasture Conditions," *Welsh Plant Breeding Station*, Bulletin Series H., No. 3.

years of good sward that must be obtained to constitute a paying proposition it must be remembered that increased autumn, winter and early spring grazing has an altogether greater value than increased late spring and summer grazing.

Evidence from trials in progress at the station suggests three species in particular which can be relied upon to assist wild white clover to make a permanent sward rapidly, namely, rough-stalked meadow grass, crested dog's tail and indigenous perennial rye grass—and all of these species when fairly established exert a decided influence on the grazing available during the dead season.

It is not improbable that "ex Wild White" perennial rye grass in cases where the seed has in fact been taken off genuine old permanent pastures might alone and unaided be competent to give the necessary assistance to wild white clover. Until further trials with the commercial seed of this rye grass, now to a limited extent finding its way on to the market, have been conducted it would, however, be wiser, particularly in regions of high rainfall, to place at least a measure of reliance on crested dog's tail for the poorest soils and on rough-stalked meadow grass for poor and good soils alike.

To conclude, and acting on the very reasonable assumption that the farmer is both able and willing to experiment for himself, the writer may perhaps be permitted to suggest the basis on which a mixture for the purposes under review should be drawn up. The following mixture, per acre, with alternatives, is put forward on the assumption that the field will be grazed for the first time about 6, 8, or 10 weeks after sowing, and will be used thereafter only as a pasture:—

	lb. per acre.	
Mustard ... ..	5	} or rape 5 lb.
Hardy Green Turnips ...	2	
Italian Rye Grass ...	6-8	} or 12 lb. if rough-stalked meadow grass and crested dog's tail are excluded.
Indigenous Perennial Rye Grass ... ..	6-8	
Rough-stalked Meadow Grass* ... ..	3	} or 1½ or 2 lb. of each of these species.
or Crested Dog's Tail*	3	
Montgomery or Cornish Marl (extra late) Red Clover ...	6	The viability of these strains is generally rather low. According to degree of excellence of "take" prognosticated.
Wild White Clover ...	1-3	

\* It is of some significance to note that the ordinary commercial seed of rough-stalked meadow grass and crested dog's tail does not give rise to plants differing so profoundly from true indigenous seed as is the case for instance with perennial rye grass, cocksfoot and timothy.



The experiment under review certainly suggested that for poor conditions of soil and tilth the seed rates therein adopted, even for Italian rye grass and wild white clover (successful as they were), were hardly sufficient. To be too sparing in the two pivotal ingredients would be to jeopardise the whole success of the undertaking. It must also be remembered on the one hand that the viability of the genuine Montgomery and Cornish Marl red clovers is usually considerably lower than that of Eastern Counties or foreign red clovers, and on the other hand that the powers of establishment of crested dog's tail and rough-stalked meadow grass are not particularly good, even though the viability of the seed may be excellent.

The writer is indebted to his colleagues, Capt. Williams, B.Sc., Mr. Martin Jones, B.Sc., and Mr. William Davies, B.Sc., for invaluable assistance in the conduct of the experiment and in the preparation of the data on which this article has been based.

\* \* \* \* \*

## ENSILAGE.—V.

### STACK SILAGE.

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STACK silage, like clamp silage, can be made without capital expenditure, nor is any preparation such as the excavation of the pit for clamp silage, generally necessary. The method can, therefore, be brought into operation at a moment's notice, as, for example, when a crop has been cut for hay and partially spoilt by rain. Such a case occurred on the University Farm at Cambridge in 1924, when a partially spoilt crop of clover and ryegrass was converted into a useful stack of silage. In the same way second crops of seeds or grass at the end of summer may be converted into valuable fodder by this method, in weather totally unsuited to hay-making. Wibberley even claims to have demonstrated that a crop of mustard can be made into good silage in the stack, whereas this crop is not suitable for silage making in the clamp or in the tower silo. All these are emphatic advantages, but, as will be shown later, stack silage, unless made on a very large scale, is liable to be associated with excessive wastage by moulding on the outside.

Stack silage by reason of its exposure to air and the difficulty of thorough consolidation, favours rapid fermentation which, though producing sweet, palatable silage, may lead to excessive loss of food material during fermentation. Another consequence of such rapid fermentation, especially when irregularly distributed in the stack, is the tendency of the stack to settle irregularly and possibly to slip or overturn.

**Building the Stack.**—The position of the stack should be chosen both in relation to the field where the crop is grown and the use of the silage. The stack should be rectangular with rounded corners; angular corners cannot be kept sufficiently compact to prevent access of air and moulding. The dimensions should be as large as the crop to be ensiled justifies; a single large stack is preferable to two smaller ones, because it entails a relatively smaller proportion of outside exposed, and therefore less wastage. The floor of the stack, so long as it is not situated in a hollow into which water might drain, requires no layer of straw, since if dry straw or other porous material is used it tends to admit air and the silage in contact with it moulds. The silage crop is therefore stacked directly upon the earth floor.

The danger of producing sour silage at the bottom, so common in clamp silos, is not very great, but if the crop is very green and succulent it may be desirable to build the floor of slightly dried crop or to give the bottom of the stack (4-5 ft. high) a couple of days to heat before proceeding. Except in the above-mentioned case, and especially as building proceeds, the tendency will be for the temperature to rise excessively; this should be counteracted by efficient trampling when stacking the freshly-cut crop, and by stacking as fast as the settling of the stack allows.

Some makers of stack silage advocate the sprinkling of common salt over the stack whilst building proceeds, to reduce the intensity of this heating. Wibberley advocates the pouring of brine solution into a stack that is heating excessively, but the writer has no experience of either of these methods.

The walls of the stack should be almost vertical or very slightly drawn in as the stack is built, so that when the stack is complete and has settled there shall be a steep slope downwards over which the greater part of the rainwater will be shed. It is not good practice to allow the eaves to project as in a corn or hay stack, because the angles at the eaves would become completely mouldy owing to the impossibility of compressing



them sufficiently to exclude the air. During the building of the first half of the stack the centre should be kept only slightly "heartened" so that there may be no tendency for the sides of the stack to slip off; in the building of the latter part, however, every effort must be made to raise the centre so that the roof may have a considerable slope for the shedding of rainwater. The actual building of the stack is very heavy work, and where possible it should always be lightened by the use of an elevator or horse fork.

**Settling of the Stack.**—One of the difficulties of making stack silage is due to the fact that the stack as it heats settles enormously: the following records of a stack made at Cambridge in 1924, for which I am indebted to Mr. F. H. Hanley, B.A., will illustrate this point:—

June 9th.	Stack begun and reached 8 ft. 6 in.
June 10th.	Stack settled to 6 ft. and then stacked to 14 ft.
June 12th.	Stack settled to 8 ft. and then stacked to 14 ft.
June 13th.	Stack settled to 10 ft. and then stacked to 16 ft.
June 14th.	Stack settled to 14 ft. 6 in. and then stacked to 17 ft. 6 in.
June 18th.	Stack settled to 9 ft. and then stacked to 16 ft.
June 20th.	Stack settled to 13 ft.
July 14th.	Stacked settled to 9 ft. 6 in.
Dec. 31st.	Stacked settled to 7 ft. 6 in.

The heating and settling should be uniform, but the stack heats and settles irregularly if under the influence of continuous wind in one direction, and difficulties in adding to the height of the stack arise. Remembering that this irregular heating is generally due to continuous wind pressure driving the air into the stack on the windward side, and thus driving the heat to the leeward side, it is possible to counteract the difficulty by hanging a sailcloth along the windward side. This practice has been adopted on two separate occasions at Cambridge with silage stacks having a very dangerous lean, and in each case with the result that heat was generated on the windward side, and this settled so that the stack righted itself. The use of a sailcloth in the case of hay stacks which tend to overheat and settle unevenly is also worthy of consideration. Another method helpful in righting a leaning stack of silage consists in weighting the top of the stack on the windward side with sleepers or other weights to assist in the consolidation and settling on that side.

**Covering and Pressing.**—The most difficult part of the process of making stack silage is the covering and pressing.

If neither is done, then in a humid climate, especially when the stack is kept for six months, the wastage is excessive. It is not generally possible to cover the stack with earth like a clamp silo, because of the great labour of excavating the soil and elevating it, though Wibberley has described\* the use of the horse fork or pitch pole elevator for this purpose, using a box on the haulage rope to carry the soil instead of the fork.

Wibberley has also recommended the practice of building a straw stack or hay stack on top of the silage stack, but the obvious objections to this are that the material may not be available at the time, and that the two stacks may not be required for use at the same time.

During the first silage boom in the 'eighties, many devices were utilised for the purpose of pressing stacks, with more or less success. An example of one of the best of these is still in use on the Reading sewage farm, where stacks of rye grass silage are annually made. In this case the pressure is exerted by means of windlasses. Parallel oak beams are placed at distances of 30 in. apart across the floor of the stack, which is built upon them, leaving the ends exposed. The windlasses are attached to these exposed ends. After the stack is completed stout poles are placed horizontally along the ridge, the middle of the roof, and the eaves to take the bearing of wire hawsers which are passed over the roof at right angles with these bearers. Each hawser is attached to a windlass on either side. The operation of the windlasses draws the wire hawsers tight, from which the pressure is distributed through the poles over the stack at the will of the operator, and these hawsers are tightened from time to time as the stack settles. This is a successful method of pressing a silage stack, but entails capital expenditure upon windlasses, etc. This description of pressing stack silage is given, not for the purpose of advocating its general adoption, but to illustrate one successful method, and to point the way for other possible modifications of the plan.

At Cambridge in 1924 an attempt was made to copy this method, but in place of the windlasses bags of soil and sleepers tied to fence wires were used: the wires were passed over the stack in like manner to the wire hawsers, resting upon parallel poles on the roof, but the method was not successful: the weights rested against the sides of the stack instead of hanging clear.

\* This *Journal*, Sept., 1916: "Sweet Stack Silage," T. Wibberley.



and so failed to exert their full pressure, and mould penetrated into the roof of the stack badly.

**Wastage.**—Reference has previously been made to the great loss which may occur in silage stacks, especially when made on a small scale. This is illustrated in the case of the stack made at Cambridge in June, 1924. The stack was  $16\frac{1}{2}$  ft. wide and 27 ft. long, and in August when the stack was first cut, it was between 8 and 9 ft. high. The crop consisted mainly of Italian rye grass and clover originally cut for hay, which was washed by rain for a week while lying in the field before stacking as silage. The conditions for pressing the stack were unsatisfactory; in fact the highest temperature amounted in one place to 173 deg. F., and the very wet season contributed greatly to spoiling the exposed portions. Weighings of the amount of wastage by moulding on the roof, sides and floor were made on 23rd September, and again on 8th December. On the former occasion the waste amounted to 29 per cent., and on the latter to 35 per cent., in addition to fermentation losses amounting to an average of 10 per cent. of the good silage remaining. It is true that the resulting silage was very sweet and palatable, and that the crop as hay would in all probability have been completely spoilt by the rain. Nevertheless, although the losses were accentuated by inadequate pressure, the fact remains that they were enormous.

The conclusion to be drawn is, I think, that whilst stack silage may be a useful practice in exceptional conditions as, for example, in bad haymaking seasons, or of crops late in summer, it is not a practice to be recommended for general adoption.

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## THE DOWNY MILDEW OF THE HOP.—II.

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**Epidemic Occurrence in England in 1924.**—Previous to 1924, the Downy Mildew of the hop had been recorded from one place only in Europe, viz., in the experimental hop garden at Wye College. During the summer of 1924, the fungus was found at the Fruit and Hop Research Station, East Malling, Kent, on some young hop plants, the cuttings of which had been obtained from Wye College in 1922-23, and grown in a nursery bed during 1923. All these plants (which had been kept isolated during 1924) whether diseased or healthy, were promptly grubbed up and burnt. Later in the summer, the disease was found in the nursery bed of hop cuttings and sets at East Malling, and the whole stock of several thousand plants was burnt.

In 1923 cuttings of other plants had been raised at East Malling in the same nursery bed alongside those received from Wye, and the former had been distributed to hop growers during the winter of 1923-24. It became necessary to visit all the farms where these hops had been planted and inspect them. Consequently the farms concerned, viz., 20 in Kent, 2 in Sussex and 1 each in Hampshire, Worcestershire and Herefordshire, were visited. The disease was found on the hops sent out from East Malling Research Station in the following cases: Kent, 16 farms; Sussex, 2 farms. On the remaining farms in Kent, and on those in Hampshire, Worcestershire and Herefordshire the disease was not found. In some cases in Kent the hops had been planted out in the farmer's hop garden, and here the fungus was found on plants adjoining those obtained from the research station. Thus at Horsmonden, the fungus was found on several hills of Fuggles, and at Paddock Wood, on Tutshams. In some instances cuttings taken from quite healthy rows of hops had been sent out, and had been planted by the farmer in a nursery adjacent to cuttings taken from his own stock, and it was a surprise to find the Downy Mildew occurring to an equal extent on both sets of plants. Whilst in many cases the disease on the farms mentioned was probably due to its introduction on plants from the research station, it seems possible, in the light of knowledge acquired later, that in some of the cases the infection proceeded from another source—particularly where nettles or wild hops occurred in the immediate vicinity. At that time, however, the facts known warranted the belief that the Hop Downy Mildew had been intro-



duced into this country on imported plants, and that therefore it was imperative that all steps should be taken to stamp out the disease if that were possible. Consequently the farmers concerned were persuaded to destroy not only all the hop plants obtained from East Malling but also in some cases rows of hops in commercial hop gardens, and also some thousands of cuttings in nursery beds, which were, or might have been, contaminated. With the loyal co-operation of the farmers the destruction was secured not only of these plants, but also of those on the other farms mentioned above, which on close examination appeared to be healthy. It was eminently desirable that the destruction of these plants should take place; and even when the situation is reviewed with the help of knowledge gained later, it seems to have been the best course in view of the possibility that different forms of this fungus may exist, some of which may cause a more serious disease than others.

Later in the season the Downy Mildew was discovered in the experimental hop garden at East Malling Research Station, where new seedling varieties raised at Wye College are tested against the commercial varieties. The fungus was found both on the leaves and on the hop cones, and with a few varieties the latter were so severely affected that the crop was ruined.

At the end of September and during October fresh facts were discovered which threw an entirely new light on the subject. At the end of September a Downy Mildew was found by one of the writers on a wild hop in a roadside hedge at Westwell, near Ashford, Kent. This led to a general search being made, and during October the fungus was found on wild hops in the following parishes in Kent: Paddock Wood, East Peckham, Watlington, Selling, Hastingleigh, Hothfield, Addington, Pluckley, Egerton, and between Hothfield and Ashford. Mr. J. Amos, of the East Malling Research Station, also discovered the fungus on wild hops growing on the railway bank near East Malling Halt. Some of the localities mentioned above are so far distant from Wye as to make it highly improbable that the Downy Mildew on these wild hops in the hedges could have been derived from the experimental hop garden at Wye. It was, however, desirable to ascertain whether the fungus occurred on wild hops at a greater distance from commercial hop gardens than could be the case in Kent. One of the writers therefore visited Middlesex, and after a short search found, on waste ground at Twickenham, wild hops bearing the Downy Mildew on both the leaves and cones. Further confirmation was obtained in the following way; one of the writers

was aware of the existence of a wild hop growing in a hedge at Bickington, N. Devon; leaves from this plant were obtained, and were found to be infected by the Downy Mildew. Thus in two counties where hops are not cultivated, the fungus was found on the first hops examined. It can be regarded as proved then, that a Downy Mildew of the hop plant is certainly native to, and widely distributed in, this country.

A search was then made for the fungus in commercial hop gardens generally. At that time of the year (October) the hops had all been picked, and the bines, still bearing leaves, were either on the ground or hung over the breast wires. On the youngest of the leaves, or more rarely on the older leaves, small patches of the Downy Mildew bearing summer spores could be found. In a few cases the fungus was so abundant that the under-surface of the leaf was conspicuously blackened in places by the dense, sooty-violet patches. As a general rule, however, the patches were quite small and inconspicuous, and in no case was the infestation severe enough to have attracted the attention of any hop grower. Time permitted of the search being made in only a limited number of hop gardens, but it can be stated that in those of the district between Paddock Wood and Maidstone a general infestation occurred of the nature described above. The following are the parishes in which hop gardens containing the disease were found: Paddock Wood, East Peckham, Watlingbury, Boughton Aluph. Wye, Selling.

At one farm near Paddock Wood the fungus was found on the leaves among withered hops on the pulled-down bine. In this case it was reported to us by the farmer (an experienced hop grower) that some disease of a nature unknown to him had attacked the hop cones just before they were fit to pick, had rapidly turned them brown and completely ruined the crop. The farmer had cut the bines down over some acres, in order to prevent the disease spreading. Although no Downy Mildew was observable on the withered hops when the writers visited the farm in October, it appears possible that this was a case where a commercial hop garden in Kent had already suffered from attacks of this disease.\*

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\* Caution is needed in attributing the cause to the Downy Mildew, because in 1924 in this, as in other hop-growing countries, a disease apparently of a physiological nature and not due to any organism appeared on the ripening hop cones and discoloured them. It seems probable that this disease, which appeared in many parts of Kent, was caused by the persistent cold, wet weather, and is the same as that described on the Continent as "la maladie nouvelle," "la maladie des houblons de 1924" and "maladie rouge" in "*Le Petit Journal du Brasseur*," XXXII, Sept. 19, 26, Oct. 10 (1924).



Visits were then made to farms where cuttings of commercial varieties of hops are raised by the thousand in nursery beds and then sold. Nurseries were inspected at Malling, Boughton Aluph, Wye and Selling, and in every case the plants were found to be more or less heavily infested with the Downy Mildew. Thus at Boughton Aluph practically all the plants (rooted sets of a Golding variety) bore numerous patches of the mildew on their leaves; at Wye and Selling the sets of Bramling, Tutshams, etc., were similarly infected. In the case of some of these nurseries the sets were already sold, and will have been distributed during the past winter to hop growers not only in Kent, but also in Surrey, Hampshire, Worcestershire and Herefordshire. In one such instance it is not too much to say that every plant was more or less affected with the Downy Mildew. The injury to the leaves was negligible, and the disease under the circumstances would be passed over by the average practical man; on the attention of the grower being called to the spotting of the leaves caused by the disease, it was dismissed by him as being nothing new, of no importance and due to the natural "ripening off" of the plants. There is the probability therefore that every batch of plants sent out from this nursery (as well as from others) has carried winter spores in the soil attached to the roots, either in fragments of leaves or free in the soil. The possibility also exists that the fungus may have been transported in the form of spawn in the stem or in its buds.

Leaves of hop sets from nurseries on various farms in the Weald of Kent and in Herefordshire were also examined and found to bear the Downy Mildew.

On the greater number of the farms mentioned above, where the Downy Mildew was found in commercial hop gardens or in nurseries, no hops from either Wye or East Malling Research Station had been planted, and it was quite certain that the disease had not been introduced from either place but was occurring spontaneously. Certain facts observed on the farms visited, and elsewhere, gradually led the writers to suspect that the source of the disease existed in a very unexpected quarter. A Downy Mildew attacking nettles has long been known in this country, and during the wet autumn of 1924 was extremely prevalent in Kent, both on the Perennial Nettle (*Urtica dioica*) and on the Annual Nettle (*U. urens*). Leaves attacked by this fungus show dark angular spots similar to those caused on the hop leaf (compare Figs. 3 and 9). In the hedges surrounding Kent hop

gardens, and in most hop nurseries, nettles of both the perennial and the annual kind occurred in abundance, and it was a comparatively rare occurrence to find nettles free from the attacks of the Nettle Downy Mildew. A suspicion that the Nettle might be concerned in the sudden appearance of a Downy Mildew on the hop was strengthened by the fact that it was by no means an uncommon occurrence to find nettles bearing the Downy Mildew in the closest proximity to hop plants, both in nurseries and in roadside hedges. Sometimes the stem of the hop was twining round the nettle stem, and in one such case the hop plant was also affected with a Downy Mildew, the other hop plants near-by being healthy.

Under the microscope the Downy Mildew of the hop was found to be identical in structure with that on the nettle, except that the winter spore (*oospore*) of the former was slightly larger.

Attempts were made to establish the identity of the two Downy Mildews by making cross-inoculations, *i.e.*, taking the fungus from the hop and putting it on the nettle, and vice versa. Although the season was late for such work, and there was scanty time for obtaining the most suitable plants, the results of the experiments (which are published elsewhere in detail\*) appear to show that the Downy Mildew of the hop can infect the nettle. Of 45 leaves of the annual nettle which were inoculated with summer spores of the Downy Mildew taken from the hop, six leaves became infected; of 27 leaves of the perennial nettle inoculated from the same source, five leaves became infected. In both sets of experiments the control leaves remained healthy. Conversely, of 62 leaves of the hop inoculated with summer spores of the Downy Mildew of the nettle, eleven leaves became infected. In these experiments, however, three control leaves showed the disease, so that here the evidence becomes less trustworthy. Attempts will be made during the season of 1925 to place the question beyond doubt.

**General Considerations.**—The underlying causes of the recent appearance of this new disease of the hop must remain at present a matter of speculation. Two alternative theories may be advanced. The view may be held that the serious disease observed in the experimental hop garden at Wye College for the past five years and described above has been caused by a specialised and virulent form of the Downy Mildew

\* *Annals of Applied Biology*, Vol. XII, No. 2, 121-150 (1925) (in the press).



possibly imported into this country from abroad. This virulent form might be distinguished by its persistence on or in the hop plant during the winter, as the result of which the fungus appears year after year from the commencement of the growing season, and is thus able, given suitable weather conditions, to inflict the most serious injury on the crop. If the commercial varieties grown in this country are as susceptible to the fungus as those grown in the experimental hop garden at Wye have proved to be, it is quite certain that hop growers have had up to the present no experience of this disease, as it could not have occurred in their hop gardens without attracting attention. On the same theory the Downy Mildew which was observed in epidemic form during last autumn may be supposed to be another form of the same fungus (probably originating from the nettle and certainly native to this country) which possibly under certain weather conditions and late in the season can temporarily infect the hop plant, attacking the leaves and the cone, but not causing a permanent disease. On this view the hop plants would each year, and only under certain weather conditions, be infected afresh from diseased nettles. Such a temporary infection late in the season either in the hop garden or in the nursery would cause no appreciable harm and may well have occurred in this country in previous years without having attracted the attention of either the farmer or the scientist.

On the second theory, the fungus originally causing the disease at Wye and that found in the general epidemic of 1924 are assumed to be the same, to be native to this country on the nettle, and on this host within recent years, to have "sporting" and developed a form capable of attacking the hop in such a way that it reappears year after year in the hop garden as a dangerous disease. If this view is correct, the events which have been noted since 1920 in the garden at Wye College seem likely to be repeated during the coming years in many a hop garden in Kent. The amount of injury then caused to the hop crop will depend on the susceptibility shown by the different varieties cultivated.

In the event of the disease being observed by any hop grower, it is desirable that the nearest technical advisory centre, or the Ministry, should be immediately informed.

#### *Summary.*

1. A description is given of a new and dangerous disease of the hop, caused by the Downy Mildew (*Pseudoperonospora Humuli* (Miyabe

and Takah.) Wilson), which was first noticed in this country in 1920, in the experimental hop garden at Wye College, Kent, and which has persisted from year to year, and caused considerable injury to the crop. In a previous article in this *Journal* (vol. XXX, 430 (1923)) the belief was expressed that the fungus causing this disease had been imported from abroad.

2. In 1924 a fungus indistinguishable from the above appeared in epidemic form during the autumn in hop gardens, hop nurseries, and on wild hops in the hedges, in several counties in England under circumstances which showed that the fungus was a native of this country.

3. Investigations have shown that the Downy Mildew which is common on nettles is almost identical with that on the hop, and that it is probable that the fungus can pass from the hop to the nettle and *vice versa*.

4. Two theories are advanced to explain the appearance in England within recent years of this new disease of the hop.

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## AGRICULTURAL RESEARCH IN FRANCE.

### A COMPARISON WITH GREAT BRITAIN.

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THE modern development of agricultural research in France is even more recent than in Great Britain, for whereas in the latter case it dates from the Development and Road Improvement Funds Act of 1909, the charter in the former case is the French Finance Act of 30th April, 1921. This law created at the Ministry of Agriculture an "Institute of Agricultural\* Research" charged with the duty of "developing scientific research applied to agriculture with the view of increasing and intensifying agricultural production." There were a number of agricultural stations in existence previous to the establishment of the Institute, but they were badly staffed, research work was largely sacrificed to analytical work carried out to secure fees, the whole field of agricultural science was not covered, and the local stations were unevenly distributed over the country. The Institute has the task of thoroughly reorganising the agricultural research work, and of placing it on a satisfactory footing.

#### **Status of Research Stations and Nature of Research Grants.**

—In France agricultural research is largely a strictly Govern-

\* Agronomique has throughout been translated as "agricultural."



ment service. There are now some 88 stations and laboratories in that country, 58 of which are Government stations staffed by Government servants and controlled by the Institute of Agricultural Research. The chief centres are Paris, Versailles, Bordeaux, Clermont-Ferrand, Grignon, Montpellier and Rennes. In Great Britain, however, the policy has been adopted of entrusting agricultural research to research institutes either independently governed, or attached to Universities, grants in aid of expenditure of such institutes being made from Government funds (the Development Fund).

The French stations which are not Government stations belong mainly to local authorities. The practice as regards grants by the Institute to these stations is very much the same as in this country. The French Agricultural Research Institute gives grants (1) to university laboratories and other independent institutions, (2) to agricultural stations of the various departments, (3) to individual scientists working on agricultural problems. The first corresponds to British research institute practice, the second to grants to local authorities in this country for experimental work, and the third to special grants given in this country to individual investigators (through their institutes) for agricultural research into specific problems.

**Governing Body.**—The governing body of the French Agricultural Research Institute is the Administrative Council, on which the representatives of the Ministry of Agriculture have a majority—of the 28 members, 6 are nominated by the Academy of Science, 6 by the Academy of Agriculture and 16 by the Ministry of Agriculture. Of the nominees of the Ministry of Agriculture, 3 are Members of Parliament, 3 are agricultural or scientific notabilities, 3 are members of agricultural associations, and one represents the Ministry of Finance. The Director of the Agricultural Research Institute is an additional member of the Council; this appointment is made by the Ministry of Agriculture.

The Council's deliberations relate to financial and accounting matters; acceptance of gifts and legacies (the Institute is empowered to receive these); investment and borrowing of funds; the use of funds given to the Institute by local authorities; the formation or suppression of stations; the budgets and accounts of individual stations; and all questions concerning the personnel and work of the stations. The decisions of the Council can only be put into effect after approval of the Ministry of Agriculture.

So far as its deliberative functions are concerned this Council corresponds to some extent to the British Agricultural Research Council (composed, however, for the most part of directors of research institutes in England, Wales and Scotland), which meets for discussion of questions concerning research work. The administration of grants to institutes, and financial arrangements generally are in this country, however, retained by the Ministry of Agriculture and the Board of Agriculture for Scotland respectively. On technical questions the British Agricultural Research Council has another counterpart in France—the meeting of directors of stations. This question is further dealt with below under “co-ordination of research work.”

**Subject Division for Purposes of Research : Research Programmes.**—The policy adopted in this country of dividing up the science of agriculture into subjects for the purpose of research, and of entrusting each subject to a different station, is being followed in France. The following is a comparison of the subject divisions :—

<i>Great Britain.</i>	<i>France.</i>
Soils (Plant Nutrition).	Soils.
Plant Pathology.	{ Entomology.
Plant Physiology.	{ Mycology.
Plant Breeding and Crop Improvement.	—
Horticulture.	Plant Breeding.
Glasshouse Crops.	—
Animal Nutrition.	—
Dairying.	Animal Nutrition.
Animal Breeding.	—
Animal Pathology (including Agricultural Parasitology).	Animal Breeding.
Agricultural Economics.	Animal Pathology.
Agricultural Engineering.	—
—	Agricultural Engineering.
—	Agricultural Physics and Meteorology.
	Agricultural Bacteriology.

The chief apparent omissions in the French programme compared with the British are plant physiology, horticulture, glasshouse crops, dairying and economics. Some of the British work on plant physiology corresponds to work allotted in France to the agricultural physics and meteorological stations. Doubtless too a good deal of the work carried out at our horticultural and glasshouse crops stations will in France be conducted at the stations for plant pathology and plant breeding ; similarly dairying



work may also be carried out at the animal nutrition and breeding stations, and is dealt with to some extent at the bacteriological station (see later). Agricultural economics does not come within the French Agricultural Research Institute programme because it is entrusted by the Ministry of Agriculture to its Agricultural Intelligence Office; very little seems to have been done on this subject, however, and there is no provision for dealing with costing records by localities as in this country.

There are no separately recognised stations in this country for either agricultural physics and meteorology or agricultural bacteriology. The French research programme in agricultural physics and meteorology is thus defined: "Research into methods of using natural forces—whether thermal, actinic, electrical, magnetic, radio-active—in the development of plants. Research into methods of protecting crops against harmful meteorological phenomena, *e.g.*, frost, hail, etc. Research on the utilisation of meteorological observations in forecasting crop yields, and in predicting outbreaks of plant disease for the purpose of forewarning farmers."

In our own country work on soil physics is carried out at Rothamsted, and the Agricultural Engineering Institute at Oxford will also be concerned in the question. Agricultural meteorological work has been carried out hitherto in rather haphazard fashion, the principal station concerned being Rothamsted; observations have, however, been made elsewhere, *e.g.*, Cambridge, Cockle Park, Wisley, Newton Rigg, etc. Under a scheme now inaugurated by the Ministry (of which full particulars will be published elsewhere) this country is covered with crop weather stations at which both meteorological and crop observations (including phenological and plant pest observations) will be carried out, and attempts will be made by an *ad hoc* Standing Committee of the Ministry to correlate the two sets of observations. There is also a Committee of the Ministry for electro-culture research, carried out under the direction of the Plant Physiology Research Institute.

The following work is allocated to the French Agricultural Bacteriological Station: research for improving the fermentation industries, *e.g.*, wine making, cider making, brewing, distilling, vinegar making, cheese-making, butter-making, and flax retting. Work under these heads has not been brought together in this way in this country. Cider making is dealt with at the Long Ashton Research Station; brewing and distilling research is carried on by the Institute of Brewing, which, instead of receiving

a subsidy from Government funds, itself subsidises agricultural research on problems bearing on the brewing industry; research in cheese-making and butter-making is carried out at the National Institute for Research in Dairying; research into problems of flax and linen has hitherto been dealt with principally by the Linen Industry Research Association, which receives support from the Department of Scientific and Industrial Research and the Government of Northern Ireland.

The work to be dealt with in France under soils, plant breeding, animal breeding and animal pathology sufficiently resembles the programme of research institutes dealing with these subjects in this country to need no comment.

As regards agricultural entomology (zoology) it may be noted that, as in this country, bee-keeping is included, but the zoological programme in France is wide enough to include ornithological research directed to the protection of insectivorous birds and the destruction of harmful birds, and research into methods for the destruction of rats and mice and other small harmful animals. Of importance in France also is research in silkworm rearing. In this country rat destruction research is a matter in which the Ministry of Agriculture has directly concerned itself.

The mycological research programme in France is wider than the usual conception of such research in this country in that, in addition to dealing with fungus and bacterial diseases, it includes the destruction of weeds and parasitic plants and destruction caused by physical agents.

The French programme of nutrition research covers both animals and man, and includes research into poisoning, a subject which in this country is usually regarded as coming within the purview of animal pathology research institutes (so far as animals are concerned).

The agricultural engineering research programme in France is defined simply as the testing of motors and agricultural machines, apparently indicating a conception of the work less fundamental than in this country.

**Co-ordination of Research Work.**—Akin to the British Agricultural Research Council from the point of view of co-ordination are periodical meetings of the directors of French agricultural research stations and laboratories. Such meetings are held by the Council of the Institute to be desirable “because they lead to a closer and more efficient scientific collaboration between institutions whose programmes have many points in common, and aim at the same ends; it is often by an interchange of views



between technical men specialising in the same branch of knowledge that a method of analysis or a new process is brought to the test." Judging by the following list of the principal questions discussed at such a conference in 1923, it might have been held on British soil:—Agricultural soils and mapping; improvement of analytical methods; new manures and old methods of valuation; crop experiments; collaboration of chemist and geneticist; the importance of minute quantities of chemical compounds; analyses of feeding stuffs. A second meeting of station directors is to be held in Paris in April, 1925.

In order to ensure proper co-ordination the Administrative Council of the Institute has five technical committees: (1) Soils, (2) plants, (3) hygiene and feeding, (4) engineering, and (5) physics and meteorology.

The aim of the French Government is to have one central station for each of the ten groups of subjects into which agriculture has been sub-divided; it will be the duty of each of these central stations to co-ordinate the efforts of all the stations working on subjects within its group and to centralise the results. This does not, however, mean that the latter stations will be subordinate to the central station; they will retain their independence both administratively and technically, and will not necessarily become provincial dependents of the central station.

It is interesting to compare this aim with practice in this country. In subjects in which there are two or more research institutes, *e.g.*, soils, horticulture, plant breeding, animal nutrition, animal breeding and animal diseases, there is no question of any one station being regarded as subordinate to others; each preserves administrative and technical independence. Provision for co-ordination of work is made as already mentioned through the Agricultural Research Council, through frequent meetings of directors apart from the Council, and through special committees in the case of horticulture and animal diseases. A special arrangement obtains in this country as regards poultry: although feeding and breeding are dealt with at the different research institutes in these subjects, the work is co-ordinated and centralised in the National Poultry Institute. Somewhat closer co-ordination and centralisation has been adopted here, especially as regards crop improvement research and agricultural economic research. In the case of crop improvement, stations entirely subsidiary, technically, to the National Institute of Agricultural Botany have been established in various localities, and in the case of agricultural economics the work of advisory officers in

agricultural economics (who carry out economic investigations in the different provinces) is centralised at the Oxford University Institute for Research in Agricultural Economics. The organisation of provincial advisory officers in plant pathology is also used for co-ordinated work on any particular plant disease problem, and, so far as advisory officers generally are concerned, conferences are regularly held to ensure proper co-ordination of work. Further, a scheme has been inaugurated for research in pig husbandry in which research at several stations will be co-ordinated and centralised at the Animal Nutrition Research Institute at Cambridge. The practice of Research Institutes themselves establishing centres to test a particular problem seems to be growing in this country; it has been adopted notably by the Rothamsted Station and the Welsh Plant Breeding Station.

While dealing with the question of the co-ordination of experimental work, mention must be made of the action of the Ministry in preparing schemes of work on such subjects as agricultural meteorology, grassland improvement, and potato varieties. In general, co-ordination of experimental work carried out by agricultural colleges and county agricultural education authorities is regarded as a function of the Provincial Conferences—bodies principally composed of representatives of these colleges and authorities.

**Practical Application and Publication of Results.**—Arrangements have been made in France for linking the research station with farming practice. As soon as a result has been obtained by a research station which appears to have practical application, experiments under practical conditions are to be carried out jointly by the research station in question and the “Agricultural Offices” of the local authorities (departmental and regional) in France: the experiments are to be carried out for a sufficient length of time to test thoroughly the point under consideration. If the experiments confirm the research station results it is then the duty of the Agricultural Offices to popularise the methods or products by carrying out demonstrations. It is hoped in this way both to prevent premature recommendation of discoveries with consequent mistrust of scientific methods, and to secure publicity for results of proven value. The local stations, independently of this work for central research stations, carry out trials under practical conditions of methods, processes and products (including crop varieties) the use of which it appears might be of value locally. Such stations are also entrusted with



the work of multiplication of varieties and their sale; for the latter purpose associations of farmers willing to use improved varieties are formed.

In England and Wales there are various links between the results of fundamental research at the research institute and their application by the farmer in actual practice. The chief are the specialist advisory officers in various subjects (plant pathology, chemistry, economics, veterinary science) who carry out local investigations in which the fundamental results obtained at agricultural research institutes are applied to local conditions, and who also give advice; and the agricultural organisers and staffs of local agricultural education authorities, whose duty it is to keep abreast of current research for the purposes of their advisory work among farmers (which includes lectures, visits of advice, and demonstrations). Results of research also find a place in the agricultural press, and in this connection the *Journal*, leaflets and miscellaneous publications of the Ministry play an important part. Arrangements have been made recently for special series of lectures on research work to be delivered to audiences provided by the National Farmers' Union, and to be broadcast by the British Broadcasting Company.

An arrangement which does not obtain in Britain is made in France regarding the publication of research work. The Institute of Agricultural Research has two official organs for the purpose: the *Annales de la Science Agronomique*, and the *Annales des Epiphyties*. These are devoted to the results of all research work of interest carried out in the stations and laboratories of the Institute, and it is proposed that they shall also contain as complete a summary as possible of agricultural scientific work carried out in France and abroad. At present the accounts of such work are scattered among a host of publications of which the majority appear irregularly or have not sufficient agricultural interest to justify regular subscription. The Institute holds that it would be advantageous for many of these publications to disappear and for the work to be centralised as proposed. The present view in this country is that so long as the practical application of results of research work appears in the Ministry's *Journal*, leaflets, or miscellaneous publications, or in the agricultural press, agriculturists' needs are fully met, and that scientific workers are best left to publish an account of their work from the scientific point of view in the many scientific journals which

exist for the purpose. It must be remembered that the summarising of the results of research abroad is a very costly undertaking, and existing agencies are already at work on the task, viz., the International Agricultural Institute and the United States Department of Agriculture (which publishes the Experiment Station Record).

**Finance of Research Work.**—The funds at the disposal of the French Institute of Agricultural Research consist of sums previously available annually, and now transferred, for the payment of salaries of personnel, maintenance of Government research stations and laboratories, and for subsidising other research stations, etc., together with a new annual sum of two million francs provided for the purpose of filling up gaps in the research scheme by additions to stations, staffs, buildings and equipment. The budget of the Institute forms part of that of the Ministry of Agriculture, and amounted in 1923 to 4,472,000 francs; but to this must be added the receipts from certain taxes, subsidies from local authorities for the upkeep of stations and fees for analyses, bringing the total for 1923 to 5,561,000 francs. The expenditure in that year amounted to 4,079,000 francs so that there was a considerable sum unspent, unforeseen delays having occurred in the commencement of various building operations. The excess of income over expenditure is invested for the future benefit of the Institute. The total funds at the disposal of the Institute in 1924 exceed 6,000,000 francs.

This expenditure compares with a total expenditure from Government funds on agricultural research in England and Wales in 1923-24 of some £158,000 (this sum excludes expenditure on specialist advisory work and also grants in aid of experimental work by local agricultural authorities). Of this sum £140,000 was spent in grants in aid of capital and maintenance expenditure of Research Institutes.

The sums spent in France on upkeep of Government stations and in subsidies towards the upkeep of other stations amounted to 3,400,000 francs (of which salaries accounted for 2,455,000 francs). In addition sums were spent as follows in 1923 in completing equipment of stations: Machinery Testing Station (Paris), 80,000 francs; Veterinary Research Laboratory (Alfort), 92,400 francs; Phytopathological Station (Paris), 14,000 francs; Insectary (Mentone), 26,700 francs; Food Hygiene Station (Paris), 125,000 francs. The administrative council of the Institute has adopted the policy of concentrating agricultural research at certain centres. Thus at Versailles



buildings are being erected to house stations for the following :—plant pathology (zoology and mycology), plant breeding, soils, agricultural physics and meteorology; at Bordeaux for the following :—entomology, mycology, physics and meteorology, oenology; at Clermont-Ferrand for physics and meteorology, entomology and mycology.

The cost of the building at Versailles is estimated at 1,708,000 francs, and 17,000 francs has already been provided for working capital for the 42 acres of arable land attached to the centre. A building near Bordeaux has been acquired by means of a fund of 200,000 francs placed at the disposal of the Agricultural Research Institute by the Department of Gironde; and a building near Clermont-Ferrand has been acquired as the result of the provision of a sum of 200,000 francs by the Department of Puy-de-Dôme.

Subsidies to individual workers in 1923 amounted to 149,000 francs; this compares with special research grants in England and Wales in 1923-24 amounting to £3,094. In France, individual agricultural workers benefit in this way from other sources; an additional 254,000 francs was given in 1923 by various bodies. As the result of action by the French Academy of Science a general review of grants so made will be carried out each year in order to avoid duplication and over-lapping.

A statement made by the President of the Administrative Council of the Institute is worth quoting: "The funds at present placed at the disposal of the Institute are insufficient to permit it to carry out efficiently the work which it has undertaken; there will be a loss of precious time to agriculture, which hopes so much from scientific research and which impatiently awaits the solution of a large number of problems which it has placed before the Institute. It must be realised that the Institute will be able to obtain its own resources only very slowly. The problems on which it is engaged are of too general a character for their solution to serve the interest of any particular groups of agriculturists from whom support could be claimed. It is thus on the whole nation. *i.e.*, on State funds, that the Institute will have to rely for some time."

**Staff.**—The superior administrative staff of the Institute, who are civil servants, comprise a director, a "chef de bureau," a deputy chef de bureau, and an accountant.

The superior staff of the stations and laboratories comprised in 1923, 3 general inspectors, 3 directors of central stations, 52 directors of laboratories and 28 deputy directors. Of these,

8 directors, 6 deputy directors and 11 assistants were lent to subsidised stations: this is held to be a most effective way of aiding such stations.

The total salaries of the staffs of stations belonging to the Institute or lent to subsidised stations amounted in 1923 to 2,455,000 francs.

The recruitment of the technical staff presents great difficulties on account of the low commencing salary—6,000 francs. At the last examination for these posts two-thirds of the candidates were women, and the first three successful candidates were women. This is causing some anxiety as regards the supply of trained workers for the higher posts, since the majority of the women may be expected to marry and give up the service.

There seems to be no system in France for providing suitable recruits by means of Agricultural Research Scholarships in various subjects such as are offered in this country.

Very few women enter the research service in this country.

Research workers entering the French service probably compare with non-graded workers in this country, for whom there are no fixed rates, but who seldom rise above £300 per annum. The rates, however, fixed for graded research workers in England and Wales are:—Assistant, £300-£360 per annum; Senior Assistant, £400-£600 per annum; Principal Assistant, £600-£800 per annum—in each case with a small bonus varying with the cost of living, at present averaging about £45 per annum. The salary of Directors of Research Institutes in this country is in no instance less than £800.

The staffs of Research Institutes in this country are not in any way Civil Servants; they are employees of the governing body of the Institute.

**Conclusion.**—It will be seen that there are very many points of similarity in the organisation of agricultural research in Great Britain and in France. If, in France, there is a greater tendency to centralisation, this is not so great as we might expect having regard to the administrative history of the country. The looser organisation traditional in this country is gradually being tightened up, but not in such a way as to impair the freedom of the workers. Both as regards their personal emoluments and the provision of equipment, the research workers in France, even allowing for different standards of living and prices, seem to be at a disadvantage financially compared with research workers here, where as a nation we are not supposed to have a high regard for the claims of science.



## CULTIVATION OF THE VEGETABLE MARROW.

**Origin and Description.**—The species and varieties of marrows, to which the gourd and pumpkin belong, are very numerous, and are all classed as tender or half-hardy annuals. They are monœcious, that is, the male and female flowers are distinct, but are borne on the same plant. All are natives of the warm parts of both hemispheres, and particularly India. Being hardier than their allies, the melon and cucumber, they succeed well as an outdoor crop in this country in ordinary seasons, providing an open sunny position is afforded, and high bleak situations are avoided. Although tender, the marrow is most accommodating in its requirements, and will grow in almost any kind of soil in which the roots can run freely and a sufficiency of moisture can be maintained, for the plant will not stand dryness.

**Varieties.**—Varieties of marrows cross so readily with each other that great difficulty is experienced in keeping any one variety distinct if other sorts are growing in the near neighbourhood and flowering at the same time. The abundant pollen grains are freely transmitted by wind and other agencies, as, for instance, the bumble bee, while not infrequently domesticated bees show a special taste for foraging on marrow flowers.

The varieties most favoured for garden or field culture are the Long White and Long Green, both smooth and ribbed, and they may be of either the bush or trailing types. There are various strains of these, some of which are quite distinct in shape, colour and texture of the fruit, as well as in freedom of cropping and earliness. Again, foliage and habit of growth are characteristic of some strains. The finely cut foliage of one, or the more rounded glaucous and marbled leaf surface of another is suggestive of their near relationship with the ornamental gourds and pumpkins of the Continent. These special types are generally to be found in the principle marrow-growing areas of Worcester, Bedford, Cambridge, Cheshire and the home counties, and are obtained from seed saved by growers from selected plants.

**Propagation from Seed.**—Well ripened seed is essential. Some growers who select and harvest their own seed prefer to use two-year-old seed, which, when kept carefully, becomes fully ripened and matured. As a means of encouraging quick germination, the seed may be placed in a canvas bag and soaked

for twelve hours in tepid water, or it can be spread out in thin layers in shallow boxes, moistened, covered with damp moss, fibre, or leaf mould, and placed in a warm greenhouse or store for thirty-six hours.

Two methods of raising plants from seed are usually practised :—

(1) Sowing the seed in pots under glass in early spring for transplanting to heated boxes and lights, frames, or heated pits for early cropping.

(2) Sowing the seed in the open where the plants are to produce their crop.

(1) For the first method three-inch pots filled with a compost of leaf mould, sand and loam in equal parts, or, failing this, any good garden soil, made light and porous by a mixture of sand or brick rubble, will suffice. Two seeds should be put in each pot in March, and covered with soil to the depth of  $1\frac{1}{2}$  in., placing the seeds as far apart as possible near the edge of the pot. As the seedlings appear they should be kept close to the glass to encourage sturdy growth, the stronger plant being eventually retained in each pot and the other pulled out. In the Evesham district three or four seeds are sown in a pot.

On the appearance of the first pair of rough leaves the plants should be planted out in their fruiting quarters in boxes and lights, frames, or pits, in which some form of heating can be controlled either by a fermenting material or by hot water pipes. To maintain a safe night temperature, covering in the form of mats, straw or bracken is necessary during cold spells of weather. The white bush form of marrow is most suitable for early cropping under glass.

(2) Marrows are usually sown in the open in May. The usual method is to excavate shallow holes  $1\frac{1}{2}$  to 2 ft. in diameter and 8 to 9 in. in depth, placing in the bottom two or three spadefuls of good well-rotted manure or other decaying vegetable refuse. Fresh manure should not be used. This is then covered with 8 to 9 in. of the excavated soil, or if the soil is poor or low in friability, by a top spit of good decayed turf. On filling in, a shallow mound will be left, on the top of which three seeds in the form of an equilateral triangle 8 to 10 in. apart should be buried  $1\frac{1}{2}$  in. deep. The resulting plants when in rough leaf should be singled so that one plant remains to each mound. Pot-raised plants for outdoor cropping may be planted out in a similar manner or singly on the flat.

Protection in some form is necessary for the seed beds and for the plants after they have been put out. Failing bell glasses



or hand lights, a ring of sheet tin or zinc, 12 in. in diameter and about 4 to 6 in. in depth, put over the seeds and covered with a sheet of glass weighted down with a stone, will suffice. Such protection is necessary for seed sown in April or early May, or for plants put out about this period. For later sowings or planting out at the end of May, inverted plant pots, bushel baskets, or oiled paper (thin wrapping paper dipped in linseed oil) form sufficient protection as a night covering until the danger of frost is past.

**General Cultivation.**—Marrows, whether they be grown in frames or in the open, respond to generous treatment, and will well repay the grower for the extra care and cost involved in providing for the crop as many favourable conditions as possible. Frame culture is of considerable importance because early marrows are much valued, and often realise high prices. Three conditions are essential to success in growing them under more or less artificial conditions :—

(1) A moderate bottom heat from fermenting material, and hot water pipes for top heat.

(2) A mellow loamy soil, in which the roots can run freely.

(3) Sufficient water, for the marrow is a thirsty plant, and the more vigorous the growth the more satisfactory the result.

*In Frames.*—The temperature for early marrows in frames may range from 55° F. to 80° F., the safe medium being about 65° F. when the weather is cold and dull, up to 80° F. when strong sunshine prevails and the plants are growing freely with plenty of air. The crop must be ventilated freely on all favourable occasions.

Regular supplies of water (at the same temperature as the pits) must be supplied so that the bed is always reasonably moist, care being taken not to direct the water on to the main stems of the plants. A light spray of water over the foliage before closing down in the evening is also beneficial. Care should be exercised in the regular use of water, for failure will result in a deficiency of fruit. A little soot occasionally sprinkled around the young plants and over the soil surface will help to ward off slugs and will stimulate the crop. If the plants show signs of weakness liquid manure should be applied to the soil around them. Sulphate of ammonia and superphosphate can be applied at the rate of 1 oz. to the square yard and watered in.

If trailing varieties are grown the training out of the plants is a simple matter. They should run their own way until they have made shoots eighteen inches long, then the points should be nipped out. after which there should be no more stopping. but

occasionally the laterals must be suppressed to prevent crowding. The point at which the plant should be stopped is determined to some extent by its vigour, and some growers do not stop shoots until they are 3 to 4 ft. long. Bush marrows should not be stopped.

To ensure an early set of fruit, hand fertilisation should be resorted to as soon as the fruit flowers (female) appear. It will generally be found that the male flowers are the first to appear, generally in clusters near the base of the main stem or shoots.

*In the Open.*—If seed is sown outside generous treatment is equally important. Where land and labour are costly, and the summer season not too certain, it pays to provide every possible favourable condition for the crop.

If one can choose, a black soil is to be preferred, as such soils are warmer and more favourable to the early growth of the plant than a heavy loam or clay soil, though both of these can and do produce good crops of marrows when deeply worked and liberally treated with organic matter.

The marrow crop usually follows a crop of late brassicas, such as sprouts, savoys, or cauliflowers. These crops coming off the ground early in the year allow the grower time to work the land well and obtain a good tilth. Marrows benefit by shelter during their initial stages of growth, and can be grown with advantage on "lands" divided by "breaks" of broad beans.

The average distance allowed between the rows of bush marrows is 4 ft., and between the plants 3 ft., whilst the trailing varieties may be 4 ft. between the plants, and at least 8 to 10 ft. from row to row. With the latter, intercropping with catch crops of lettuce, radish, spinach or early turnips can be carried out, allowing two feet between the intercropping rows for horse hoeing and surface cleaning.

Providing the soil has been deeply worked, and contains plenty of humus, and a surface tilth is kept up, it should be sufficiently retentive of moisture to carry the plants on until they have formed a good root system, and have sufficient foliage to shade the ground. If, however, there should be a partial or absolute drought during the early growth of the plants it may be necessary to water them, but this should be done with great caution. It would be better and certainly safer to apply a light mulch of short litter or half decayed vegetable refuse, and if water must be used as a last resort, to leave it first exposed for some hours to the air in open tanks or barrels. Mulching



also serves to protect the marrows from being splashed with mud during heavy rain.

When the plants commence to fruit an occasional dressing of sulphate of ammonia and superphosphate can be given at the same rate as for the frame crop, or fish guano, at the rate of 1 oz. per square yard, may be hoed in between the rows of plants.

**Cutting the Crop.**—The marrows should be cut when quite young, the earliest fruits being about 8 inches long when marketed, and in no case should they be allowed to remain on the plant beyond medium size. The production of the young fruits does not to any appreciable degree exhaust the plants for successional cropping. When, however, the fruits are allowed to develop, and the fruit stalk to become hard, the production of fresh fruits is quickly brought to an end.

**Marketing.**—The earliest marrows are usually wrapped in rhubarb or cabbage leaves, and packed between layers of paper in half-bushel hampers or half pots holding about one and a half dozen. Later, when prices fall, about a dozen marrows are put up in a bushel hamper or pot and covered with pea haulm or straw, or about three or four dozen are marketed in a cabbage crate. They are also carried loose in market vans or lorries direct to markets or retail shops, but this is a practice not to be recommended as it leads to much damage from the constant handling necessitated.

## PESTS AND DISEASES OF THE VEGETABLE MARROW.

**Root Knot Disease.**—The pest causing this disease is among the worst that the cucumber, melon and tomato grower has to contend against. Marrows grown under glass are no less susceptible. The disease is caused by an eelworm (*Heterodera radicicola*), which burrows into the roots and causes minute warts or nodules on the rootlets, ranging from the size of a pin's head to that of a pea. Under the influence of the eelworms the root system eventually breaks down with the consequent destruction of the plants. A female eelworm is capable of laying 500 eggs, and as there are many generations in a year, the multiplication of the pest is rapid. The young worms are able to move through the soil, but only very slowly, and the spread of the pest from one bed to another is caused entirely by the transfer of contaminated material.

**Control.**—Chemicals applied to affected soil have no lasting effect, and where practicable the best measure to employ is to move all the soil to a good depth from the pits, treat the

brickwork with hot lime-wash, and bring in fresh soil. Where suitable plant exists the soil may be satisfactorily sterilised by hot steam under high pressure, or—where the soil to be treated is not large in quantity and is spread thinly—considerable effect may be obtained by the use of boiling water at the rate of 7 gallons to the cubic foot.\*

**Slugs and Woodlice.**—These pests, especially woodlice, frequently give trouble when manure from old spent hotbeds is used. Both are destructive to young plants and small fruits. Dusting round the plants with soot has the effect of deterring the pests from feeding on the plants. Dry Bordeaux mixture might also be used. it would prove more deterrent and the effect would last longer. The pests themselves may be trapped by means of pieces of potato, carrot or beet, placed under boards or slates. The traps should be examined at fairly frequent intervals and the animals destroyed.†

**Wireworms.**—Wireworms are often troublesome when marrows are grown in grassland which has been recently broken up. These insects may be very successfully trapped by means of potatoes buried just under the surface of the soil, each potato may have a stick pushed through it in order to mark its position, and to serve as a handle for lifting it when it is desired to examine it.

**Red Spider and Thrips.**—These pests not infrequently make their appearance if the atmosphere and the soil are allowed to become too dry. Consequently the best preventive, and even remedy if the attack is not too bad, is the judicious application of water to the soil, foliage, etc. Care should be taken that the water is at the same temperature as the house containing the plants.‡

**Powdery Mildew.**—Fungus diseases of marrows grown in the open are fortunately comparatively rare. The commonest is that caused by a powdery mildew (*Erysiphe cichoracearum*, D.C.), which not infrequently appears towards the end of the season when the fruiting period is almost completed. In certain seasons, however, it appears during the earlier part of the summer, especially when a period of damp weather follows one of dry heat, and it sometimes occurs on quite young plants.

\* For information on the chemical treatment of soil see Robson, *Jour. Roy Hort. Soc.*, May, 1919, Vol. 44, p. 31

† For treatment in greater detail see "Woodlice in Glasshouses," by E. R. Speyer, this *Journal*, Feb., 1924, p. 1042.

‡ For chemical treatment of a severe infestation see Speyer, *Nature*, 7th June and 9th Aug., 1924.



The leaves and younger portions of the stem become more or less covered with a white powdery growth which, under the conditions mentioned, spreads rapidly and may do considerable harm to the plant, or even kill it outright.

If the mildew does not appear until August it is perhaps scarcely worth while attempting to control its spread, but the diseased plants should be destroyed by burning. When it occurs during the earlier summer months, however, it should be dealt with immediately. Badly infected plants should be uprooted and burned, whilst those less seriously affected should be sprayed thoroughly with a solution of potassium sulphide (liver of sulphur), 1 oz. to 3 gallons of soft water. Dusting the plants with flowers of sulphur when they are damp is also an effective method of checking the disease.

Some of the diseases of melons and cucumbers under glass are also capable of attacking marrows when the latter are grown in frames or pits. Amongst them the two following may be mentioned:—

**Leaf Spot** (*Cercospora melonis*, Cke.).—This disease first appears as small pale green spots on the upper surfaces of the leaves. Later the spots increase in size and, finally, irregular patches of a grey or brownish colour are produced, the leaves frequently withering very rapidly.

All diseased leaves should be gathered at once and burned. In severe cases it is advisable to spray with a solution of liver of sulphur (1 oz. in 3 gallons of soft water) to which 1½ oz. of previously prepared and boiled flour paste have been added to facilitate wetting and adhesion. A buoyant atmosphere should be maintained round the plants by judicious ventilation. Watering should be done with discretion, and heavy dressings of stimulating fertilisers should be avoided.

**Anthracnose** (*Colletotrichum oligochætum*, Cav.).\*—In its early stages this disease also takes the form of small pale green spots on the foliage. These quickly enlarge and become round and dry. The centres of such spots usually assume a reddish colour, while the margins are more or less yellow and appear water-soaked. On them the parasitic fungus produces minute pustules in which myriads of spores are borne. Ultimately the leaves wither as the spots enlarge and unite. If not checked in the early stages the disease spreads to the leaf-stalks and young stems, causing considerable damage. The measures of

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\* See "Anthracnose of the Cucumber under Glass," by W. F. Bewley, this *Journal*, Aug., 1922, p. 469, and Sept., 1922, p. 558.

control recommended for Leaf Spot may also be used for Anthracnose. Uneven temperature and excessive dampness of the air should be guarded against, since these factors are highly favourable to the development and spread of the disease. Soil acidity should be corrected by the judicious application of lime.

**Collar-rot.**—Marrow stems sometimes rot off at their bases near soil level, or immediately behind the fruit. This is not a specific fungus disease and is usually attributed to careless watering with too cold water. If a number of drops of water remain near together on the stem, rotting usually sets in at such places. In watering marrows, it is desirable to avoid wetting the stems by applying the water at least six inches from their bases. Powdered charcoal and quicklime mixed in equal proportions and placed around the injured parts will prove of value.

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## COUNCIL OF AGRICULTURE FOR FOR ENGLAND.

THE fifteenth meeting of the Council was held at the Middlesex Guildhall, Westminster, on Thursday, 19th March, 1925. Mr. James Donaldson (Oxon.) was unanimously elected as Chairman for the year 1925. A cordial vote of thanks was passed to the retiring Chairman, Mr. George Edwards, for his services during 1924.

**Statement by the Minister of Agriculture.**—The Minister of Agriculture (the Right Hon. Edward Wood, M.P.), made a statement dealing generally with the agricultural situation. He said that at the December meeting he had referred to the prospect as a more hopeful one, and this was still the case so far as figures showed. The index number of the prices of agricultural commodities was on the whole rising, and was now three or four points higher than November.

He then referred to the abortive Agricultural Conference and informed the Council that he had, in addition to asking the organisations originally invited to the Conference, invited the Royal Agricultural Society, the Central Chamber of Agriculture, the Surveyors' Institution and the Land Agents' Society—and he now invited the Council of Agriculture—to make proposals to him so that the Government might be in possession of the views of all, and thus be in a position to develop an agricultural policy which was likely to be continued in the future and secure the industry from the danger of sudden or sharp reversals of national policy.



With regard to the Beet Sugar (Subsidy) Bill, this measure would, he hoped, be in a position to receive the Royal Assent in time to be operative by the end of the month. The Government had done its part and he thought it was up to the factories and to farmers to do theirs. In saying that, he meant that it was up to the farmers to grow adequate supplies of beet to meet the factories' requirements. The factories had agreed on terms which, from the farmer's point of view, could not be regarded as anything but satisfactory. The further outlook was one for the farmer and the factory so to develop the industry that at the end of the ten-year period it could stand well upon its own feet without a subsidy.

The Agricultural Rates Bill, which had now been passed, continued the privileges of last year's Act to agriculture, and this meant a relief of nearly three millions a year to farmers' rates. He congratulated the new Agricultural Wages Committees on the progress which they had made.

The Minister also informed the Council of the terms of reference of a Departmental Committee which he proposed to set up, jointly with the Secretary for Scotland, on the subject of Unemployment Insurance for Agricultural Workers. The Council of Agriculture had proposed the appointment of this Departmental Committee and he would refer its report to the Council for their views upon it as soon as it was issued and before any other action was taken.

The Minister added, with regard to the Report approved at the last meeting of the Council on the subject of the conditions of seasonal employment on the land, urging the Ministry to take action for the improvement of the conditions of employment of women and children, that he had conferred with the Minister of Health, and it had been decided first of all to approach the question of conditions in the Kent hopfields. A revision of model by-laws dealing with sanitary conditions was being considered by the Ministry of Health, and he hoped to issue a circular to hop growers urging co-operation with local authorities for the purpose of securing a reasonable standard of decency and comfort for those engaged in the seasonal work of hop-picking. The Ministry's inspectors would collect further material as to actual facts and conditions in relation to seasonal employment with a view to further educating public opinion upon the subject.

*The Rt. Hon. F. D. Acland* moved a vote of thanks to the Minister for his statement and asked, in regard to the proposed Committee on Unemployment Insurance, whether it would be

asked to explore the question and set out a scheme, even though a majority of the Committee was not in favour of bringing agricultural labourers within the scope of unemployment insurance.

*Mr. George Dallas* seconded the vote of thanks and congratulated the Minister on his full statement, which he said reflected the confidence of the Minister and the industry in the Council.

*Mr. R. A. Matthews* (Hereford), *Colonel G. L. Courthope*, *M.P.* (East Sussex) and *Lady Mabel Smith* desired to associate themselves with the vote of thanks. *Colonel Courthope* remarked upon the fact that with regard to the conditions of seasonal employment in the hop-fields the people themselves were often the greatest obstacles to improvement in their conditions. *Lady Mabel Smith* hoped that what was being done for the Kent hop-fields would soon be extended to the fruit-picking fields, especially the new ones, as it was always easier to start with better conditions in new schemes than to improve old ones. She inquired also as to the position of seasonal workers under the National Health Insurance. *The Minister* promised that he would consider *Mr. Acland's* point in regard to the Unemployment Insurance Committee.

**Supplies of Lime.**—*Sir Daniel Hall* referred to the suggestion made at the last meeting of the Council that a report should be furnished by the Ministry as to the adequacy and suitability of the existing sources of supply of lime for agricultural purposes. Certain inquiries had been made and it did not appear that the difficulty in regard to lime was in the supply. The price and cost of transport were, however, real difficulties. In order to get over them, there was the Ministry's scheme by which farmers who formed themselves into agricultural credit societies could obtain loans for the purchase of lime. A leaflet had been issued on the scheme and widely distributed throughout the country. So far, although many inquiries had been made, no society had yet registered itself or applied for a loan. He hoped, however, that the scheme would bear fruit in the coming year. *Colonel Wheeler* (Salop) said that it would help the supply of lime if the small lime-kilns about the country could be reopened. *Sir Merrik Burrell* added, however, that there was a lack of skilled lime-burners.

**Rural Housing.**—*The Rt. Hon. F. D. Acland* moved on behalf of the Standing Committee that its report on the question of the shortage of houses in rural districts be adopted. The report recommended that the Council should urge upon the Ministry of Agriculture the necessity of securing immediate action by the



Government to provide a large number of houses suitable for agricultural workers in rural districts as a national social question of first-class urgency and importance. He thought that rural housing tended to fall between the Chamberlain Act and the Wheatley Act. He hoped that the Government would carefully consider the principles of a Bill to be presented by Sir Alfred Knox and others. *Mr. J. T. Briggs* (Peterborough) referred to the Government's wish for a further million acres, if possible, to be brought under arable cultivation, and said that the lack of houses made it out of the question to get the necessary labour to do anything of that sort. There was a lack of sympathy and help from the Ministry of Health and the local authorities. Ever since December he had been trying to get some small assistance to build three houses on a farm of 300 acres, which had but one cottage, and he was no nearer success to-day than at the beginning. *Colonel Courthope, M.P.*, said that there was a definition of an "agricultural parish," under the existing regulations, which ruled out practically every parish which contained a villa or any residence beyond the doctor's and the squire's houses. He was told that there were hardly any rural parishes for the purposes of the Wheatley Act in the Home Counties. He would ask the Minister of Agriculture to urge the Minister of Health to exercise his discretion to prevent the ruling out, in this way, of parishes which were really agricultural. There were many rural cottages with three bedrooms, the present occupants of which—old couples or widows—only wanted two, so that it might help if two-bedroomed cottages were built for their accommodation and the larger cottages made available for the larger families. *Brig.-General Clifton Brown, M.P.* (West Sussex), said that there were thousands of cottages which ought to be occupied by agricultural labourers which were being occupied by the employees of county councils, railway companies, etc. He hoped the Ministry would ask the Minister of Health to circularise those bodies suggesting that they should find new cottages for their employees. *Mr. C. P. Hall* (Bedford) agreed with General Clifton Brown that it was the first duty of those public authorities which were pushing forward housing schemes to house their own employees. *Mr. John Beard* said that no scheme was likely to be a success if crowded with conditions, and if it attempted to fit houses to men who could not afford to rent them. A subsidy was necessary, and houses built for landworkers must be retained for them. At present, townsmen were buying cottages, or renting them furnished, as week-

end residences. Any man settled in a parish ought to be given a piece of land if he undertook to build a house upon it. With the increase in the value of land, the rent of houses would soon be put beyond the reach of agricultural workers unless safeguards were employed. If disused brickyards, old lime-kilns, and small stone quarries could be brought into commission again, housing in rural districts might be aided and a subsidy for these purposes would be worth while. Frequently, there was good brick clay in rural districts, but instead of making bricks there, they were brought at great expense from Peterborough. *Mr. Geo. Dallas* said that the question ought not to be a Party question, or even a controversial one amongst agriculturists. There was no question but that young agricultural workers were being driven away from the villages altogether. They got married and settled down in the only place where they could get a home, namely, in the town. *Mr. T. W. Atkinson* (Kesteven) said that his rural district council had recently built 72 houses and let them to agricultural workers. Rural district councils required to be reminded of their duty.

*The Minister of Agriculture* said that he had given this question very careful consideration for years past, but did not take so gloomy a view of it as *Mr. Beard* did. He had been in consultation with the Ministry of Health recently on the question and was assured that that Minister was very fully alive to its importance. *Sir Walter Berry* said that his experience was that townspeople were prepared to give double or treble as much as the agricultural labourer could pay in rent for rural cottages. *Mr. R. G. Patterson* (Staffs) said that in two villages near his farm nearly all the cottages were occupied by farm workers when he went there first. Now, the only cottages so occupied were tied cottages. Were it not for these, he could not continue his farm. There was a great demand for houses in the country from town workers, and, if no restrictions were put on the occupancy of cottages, no matter how many they built the question of rural housing for agricultural labourers would not be solved. *Mr. Haman Porter* said the land did not pay and it seemed of little use to encourage workers to settle on the land. *Mr. H. C. Gardner* (Worcester) said that the County Council had only this week passed a resolution to inquire into the manner in which his district council was doing its duty in regard to the supply of cottages. *Major Fawkes* (West Riding) said he did not think townsmen should be kept from living in the country. He would like the report referred back to the Standing Committee for



further consideration, and for a recommendation of definite action to be taken to the Council at its next meeting. *Mr. R. C. Grey* (Hunts) said that the rural district councils in his county were heartily sick of the whole question. The houses put up cost them about £900 and certain expenditure on them was being disallowed and rural district councils surcharged with it. The County Council had built 50 or 60 houses for their own employees. About a third of them only were being occupied by them. There was no housing question in his district, and, were it not for the fact that people came from urban districts to rent cottages, a number would be empty. *Mr. Acland* said that the Standing Committee would, if it were the Council's wish, certainly explore the matter further, though he thought that that should be done altogether apart from asking the Council to adopt the present Report. *Major Fawkes'* suggested amendment was then withdrawn and the Report adopted.

**Small Holdings Legislation.**—*The Chairman of the Standing Committee* (*Mr. Acland*) moved the adoption of a report which recommended that the Council should urge upon the Government—

1. To take steps to obtain a full and complete settlement of the financial position in regard to statutory small holdings by the date appointed—1st April, 1926.

2. To make a comprehensive small holdings scheme one of the main measures of their legislation programme of 1926.

3. To publish the principles on which such a scheme would be based this year, so that it may be properly considered by all concerned, with a view to facilitating its early passing into law, and its successful administration when passed.

*Sir Douglas Newton, M.P. (Cambs.)*, said that the question of the settlement was receiving the closest attention of the County Councils Association, and he thought that a satisfactory settlement would be made. The Report made no mention of allotments, and he suggested that the Minister might be asked to take steps to encourage and promote the development of allotments so as to provide security of tenure so far as practicable and compensation for disturbance. *Colonel Abel Smith* (Herts) said that with regard to (1) of the recommendations it was not, in his opinion, in the interests of the small holdings movement that the settlement should now be pressed in view of the very unstable state of agriculture. No one could say what the economic position of small holders would be in the future. He moved, therefore, that recommendation (1) be referred back to the Standing Committee for further consideration. *Mr. Geo. Edwards* seconded this amendment. *Alderman Quinney* (Birm-

ingham) spoke in favour of allotments legislation. *The Chairman* pointed out that the Report before the meeting dealt only with small holdings. *Mr. Acland* added that the Standing Committee would look into the question of allotments legislation as a separate subject, and bring it before the Council at the next meeting. Recommendation (1) was fundamental to the position which the Standing Committee had taken up. *Mr. H. W. Thomas* (Hants), *Mr. J. S. Gibbons* (Gloucester) and *Mr. R. G. Patterson* spoke against the postponement of the settlement. The amendment was put to the meeting and lost, and the original motion to adopt the Report carried.

**Election to Standing Committee.**—*Mr. R. G. Patterson* moved and *Mr. McCracken* seconded the election of *Mr. Clement Smith* (East Suffolk) to the Standing Committee of the Council in place of the Chairman, who became a member of the body *ex-officio*.

**CONTACT BETWEEN THE COUNCIL AND THE AGRICULTURAL COMMITTEE.**—*Mr. Acland* moved the adoption of the Report made by the Standing Committee on this question. It recommended that representatives appointed by Agricultural Committees should keep their Committees in touch with the work of the Council, both by furnishing reports and agenda showing intended action, where possible, and by personal reports on action taken by Council meetings. Wherever such representatives desired that copies of agenda, reports and minutes should be sent to the Secretary of their Agricultural Committee, the Secretary of the Council would send them on request by such representatives. *Mr. A. Matthews* (Hereford) spoke in favour of the recommendation, and *Mr. A. Bath* said that Agricultural Committees ought to be in possession of the details of the Council's proceedings before questions were discussed. A report of each meeting ought, he thought, also to be sent to each Agricultural Committee and placed upon the agenda for discussion. *Mr. R. W. Hall* (Hereford) said he had been much impressed by the way in which the Council transacted its business, and he thought that reports from it should be brought before Agricultural Committees. He supported the recommendation. The Report was adopted.

**REPORTS OF AGRICULTURAL ADVISORY COMMITTEE.**—*Mr. Acland* moved the adoption of a Report from the Standing Committee recommending that "as the reports of the Agricultural Advisory Committee are furnished for the information of the Council and as it is desirable that notices of motion by members of the Council should be reached before the more formal business on the agenda, no change should be made in the order on the agenda as at present followed." The motion was seconded, and the Report adopted.

**RATING OF SMALL HOLDINGS.**—*Mr. Denton Woodhead* moved:—

"That the Council urges upon the Ministry of Agriculture and County Small Holdings Committees the desirability of render-



ing every assistance in their power to any small holders whose assessment for rating purposes is on a higher level than that of occupiers of neighbouring land, with a view to objections being lodged on the ground of unfairness."

*Capt. E. T. Morris* (Herts) seconded the motion and said he thought it would be very useful if the Ministry gave instructions to its Inspectors to go into the question in order that appeals might be made and substantial reductions secured in the burden of rating which small holders were bearing. *Mr. R. W. Hall* supported the resolution. In Herefordshire the Chief Agricultural Officer was instructed to appear before the Assessment Committee and do all that was possible to obtain relief. *Mr. A. Bath* said that in Middlesex, the County Land Agent had taken up the question of rating for small holders. *Mr. H. E. S. Upcher* (Norfolk) and *Mr. R. G. Patterson* also spoke in favour of the resolution, which was put to the meeting and unanimously adopted.

DOUBLE-DIPPING FOR SHEEP SCAB.—*Mr. R. W. Hall* moved:—

"That the necessity for a unanimous double-dipping Order for the eradication of sheep scab be urged upon the Ministry of Agriculture."

He said that there appeared to be no doubt that double-dipping of sheep was essential to the eradication of sheep scab. *Col. Wheeler* seconded the motion, which was supported by *Mr. A. Matthews* and *Mr. H. Dent-Brocklehurst* (Gloucester), who said that his county had joined with nine or ten other counties in making an Order that no sheep should come into the clean area unless they had been double-dipped twice in 14 days, once just before coming into the area and once four days after arrival. *Mr. Clement Smith* (East Suffolk) said that he was sure his county would strongly oppose a compulsory double-dipping Order for clean counties. He moved an amendment:—

"That a double-dipping Order for the eradication of sheep scab be urged upon the Ministry of Agriculture for those counties where the disease exists."

The amendment was seconded by *Mr. Owen Webb* (Cambridge) and supported by *Mr. W. H. Thomas*.

*Lord Bledisloe*, Parliamentary Secretary to the Ministry of Agriculture, said that the whole question was at present under the serious consideration of the Ministry and that it would be easier in another month or so to say what the future policy in regard to sheep scab was likely to be. At present, the practice was that double-dipping within 14 days was insisted upon in the bad areas. *The Chairman* then suggested that in view of this statement it would probably be better to stand the matter over for the present. He therefore suggested that the mover and seconder might agree to withdraw the motion until the next meeting, when in all probability some definite step could be announced. This was agreed and the motion withdrawn.

SURPLUSES IN NATIONAL HEALTH INSURANCE.—*Mr. Denton Woodhead* moved:—

"That the Council should make representations to the Royal Commission on National Health Insurance showing the great injustice that would be inflicted on the agricultural industry, both employers and employed, if a system of pooling the surpluses of Approved Societies administering National Health Insurance were adopted."

*Capt. E. T. Morris* seconded the motion, which was supported by *Alderman Thomas Davies* (Durham) and *Mr. Christopher Turnor*, and carried unanimously.

GUARANTEES FOR WHEAT.—*Mr. H. W. Thomas* moved:—

“That in the national interest the cultivation of wheat should be encouraged by the Government guaranteeing the cost of production to the producer.”

*Mr. Thomas* said that he had withdrawn a similar resolution at the last meeting of the Council in view of the expected meeting of the Agricultural Conference which, however, had not taken place. Only 20 per cent. of the flour used in this country was made from home-grown wheat, and the percentage might, he thought, well be increased to 40. The Agricultural Wages Act had substantially increased the cost of corn production. He wished, however, to speak from the standpoint of the national interest. He considered guarantees justifiable as a form of national insurance. *The Chairman* drew the Council's attention to the fact that it had been invited that morning by the Minister to contribute to the body of suggestions towards a suitable agricultural policy. He did not know how far the carrying of the present motion might take the Council, and how far it might prejudice its freedom in making suggestions. He would therefore ask *Mr. Thomas* to withdraw his motion and leave the suggestion with the Standing Committee. *Mr. Thomas* agreed to this course on the understanding that the Standing Committee would take up the question.

REPORT OF AGRICULTURAL ADVISORY COMMITTEE.—*Mr. Dallas* moved that the Report (No. 9) of the proceedings of the Agricultural Advisory Committee for England and Wales be received. The motion was duly seconded. *Mr. C. P. Hall* supported it, but regretted that the Report contained no reference to land drainage. He wished to move an amendment in these terms:—

“That this Council requests the Agricultural Advisory Committee to consider the question of land drainage as being of the first and most urgent importance in connection with any proposal making for increased production.”

*Mr. Dallas* suggested that the amendment was really a recommendation to the Advisory Committee, and need not be moved as an amendment. *Mr. Hall* agreed, and *Lord Bledisloe* said that the Ministry welcomed items appearing on the agenda of the Agricultural Advisory Committee that are not put there by the Ministry. The Ministry realised the immense importance and urgency of land drainage, and had, in fact, a Bill under consideration which the County Councils Association were considering, with the object of giving county councils much larger powers than in the past over drainage areas within their administrative districts. The original motion to receive the Report was then put to the meeting and carried.

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## AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

REPORT (No. 9) to the Councils of Agriculture for England and Wales on the Proceedings of the Agricultural Advisory Committee:—This report contains a note of the proceedings of three meetings, namely, those on 1st October, and 10th December, 1924, and 4th February, 1925. The first of these three meetings was held whilst Mr. Noel Buxton was Minister.

(1) **Foot-and-Mouth Disease.**—At the first of the meetings, the Ministry's Chief Veterinary Officer reported that the position had become much more favourable. There were in England six areas only then under control, namely, in Nottingham, Lincoln, Northampton, Oxford, Wiltshire and Essex. In Scotland, there had been no outbreaks for 3 months, and representations were being made for the reduction of the 28 day period for detention of Irish store cattle on farms in Scotland to 6 days' detention, which was the period prescribed before the present recrudescence of disease. The Committee was asked to advise whether a return should not now be made to the requirement of the 6 day period so far as Scotland was concerned. The Committee agreed that it should be so, subject to a provision that if there were any deliberate attempt on the part of dealers to bring Irish cattle through Scotland with this short period into England, the Ministry ought immediately to reconsider the whole position. The question of Local Authorities' regulations restricting the movement of animals into their areas was once more considered, but it was decided to postpone it pending the report of Mr. Pretyma's Committee on Foot-and-Mouth Disease. The Committee also considered the question of penalties in prosecutions for the illegal movement of animals in contravention of Foot-and-Mouth Disease Orders. The Committee agreed that whilst the fine per head might prove a sufficient deterrent to contraventions where a number of animals was involved, it might not do so where only one or two, or a few, animals were involved. To remedy this, and as the offence was the same whether one or a number of animals was moved, it recommended that the Ministry should examine the position and see whether it was not possible to prescribe a large maximum fine for the offence.

irrespective of the number of animals whilst retaining the power to inflict a heavy penalty on the illegal movement of a large consignment.

(2) **Agricultural Co-operation and Credit.**—It was reported to the Committee that the Agricultural Organisation Society had been dissolved and that the National Farmers' Union had agreed to take over a substantial part of the work hitherto done by them. This the Ministry regarded as a hopeful sign that increased progress in the movement would be attained. The Advisory Committee on Credit and Co-operation had dealt with a number of applications for loans out of the funds which had been made available by the Government for co-operative enterprise started by farmers. These applications were from 9 societies for loans of £50,000. In 5 of the cases loans had been recommended to the total of about £12,000; in the other cases the Committee had not been able to recommend the loans asked for. The Ministry was pressing forward the work of investigation into marketing problems with a view to better advice than hitherto being available.

(3) **Liming of Land.**—It was reported that facilities under the Agricultural Credits Act, 1923, to assist farmers to obtain loans for the liming of land were available provided societies were formed, or existing societies used for the purpose. The Ministry was anxious to assist liming wherever it was required.

(4) **Proposed Conference on Agricultural Policy.**—At the meeting on 10th December, the Minister informed the Committee of the action which the Government had taken in regard to the proposed Conference. At the meeting on 4th February the Minister informed the Committee that the Workers' Union had now intimated that in their view no useful purpose would be served by their appointing representatives to the Conference as requested. As was generally known, the National Union of Agricultural Workers had decided some time earlier not to appoint representatives.

(5) **Re-introduction of Tuberculosis Order.**—The Minister consulted the Committee in regard to the proposal to re-introduce the Tuberculosis Order with the Milk and Dairies Act next September. The Committee agreed in general principle to the proposal, though the question was reserved for further consideration in detail when plans should be more mature.



(6) **Suggested Register of Movement of Live Stock.**—The Committee considered the following request which the Ministry had received from the National Farmers' Union: "In order to facilitate the operation of the Ministry's policy in foot-and-mouth disease to ask the Minister of Agriculture to issue an Order requiring all owners of live stock to maintain a register showing all movements of stock under their control." It was agreed that the matter should be looked into, and the Ministry undertook to prepare a draft Order for preliminary consideration with the recommendation which it was understood the Pretyman Committee were making on the point.

(7) **Sheep Scab Policy.**—The Committee considered a memorandum dealing with the preliminary step in revising the general Sheep Scab policy of the Ministry. It dealt with the withdrawal of "single dipping" regulations. The Committee concurred in the proposal that all single dipping regulations should be withdrawn.

(8) **Reports of other Departmental and Advisory Committees.**—Two reports of the proceedings of other Committees have been received by the Committee. (*20th February, 1925.*)

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## APRIL ON THE FARM.

J. R. BOND, M.Sc., M.B.E., N.D.A. (Hons.),  
*Agricultural Organiser for Derbyshire.*

**Seasonal Operations.**—April is one of the busiest months of the farm year. This season the first duty will probably be to complete the sowing of spring corn, for until the middle of March little land other than light soils came into drillable condition, and considerable areas had been unfit to plough. Late-sown oats are always the most badly "fritted," but the frit fly does more damage in some years than in others. It was very bad in Derbyshire in 1922. During that year, when a wet spring was followed by dry weather in May and June, I observed a badly attacked field and an excellent piece of oats over the hedge, although both had been sown late. The latter land was in high condition and the farmer practised heavy seeding, 8 bushels per acre. I believe that heavy seeding is desirable as a safeguard against frit damage when drilling in April. Malting barley should also be drilled at heavy rates when put in late, as in this case tillering is undesirable: late tillers make an uneven sample.

Another urgent matter is the manuring of meadows, followed by chain harrowing and stone picking. Attention will next be given to cultivations preparatory to drilling mangolds and marrow stem kale, which should be in the ground by the end of the month, and to potato planting. Winter corn not yet harrowed should have this attention, and the nitrogenous top dressings intended for weak crops should be applied without delay. Towards the end of the month grass and clover seeds will be sown in the more forward pieces of spring corn, earlier sowing being desirable, however, when the nurse-crop is wheat. It is a good rule to apply slag when seeding down, whether for long or for short leys, as undoubtedly slag assists towards the establishment of a good clover plant.

Many farmers are still unaware of the important results of recent experiments on methods of sowing grass and clover seeds\*; the land should be well but not deeply harrowed before sowing and, if the seed is broadcast, it should be *covered* by harrowing-in with a light harrow. Rolling may be necessary on light soils, but the harrowing-in must not be omitted. Recently a Derbyshire farmer told me that during sixteen years when he had the use of a clover seed drill he never had a missed plant; but that while farming another holding with a smaller acreage of arable land, which hardly justified the possession of a drill, he had found difficulty in obtaining a satisfactory take. There may be other factors contributing to the difficulty in this case, but the value of drilling is emphasised by farmers who have tried this method. With a suitable seed barrel, a cup-feed corn drill may be used, the coulter weights being taken off to prevent too deep penetration.

Charlock seedlings begin to appear in April, and where powdered kainit is to be tried as a means of destruction, it should be applied whilst the plant is in the rough-leaf stage. On land likely to be infested, deep drilling of a late-sown barley crop followed by chain harrowing is an effective means of keeping the weed down. The charlock germinates before the barley, and may be dealt with about a week before the barley blade appears. Deep harrowing would bring up further supplies of charlock seeds and disturb the barley too much.

**Moisture.**—In spite of the heavy rainfall of the past winter and the consequent wetness of the land, it is necessary to conserve moisture during the cultivations in preparation for root sowing. Soils and subsoils possess only a limited capacity for

\* See this *Journal*, Vol. XXIX, pp. 53, 132, 1125 and Vol. XXX, p. 1134.



moisture, and root crops in particular require larger quantities of water than ordinarily reach the roots in the form of summer rain. Pending the main tillage operations, the entire green-crop area should be kept mulched with a surface layer of loose dry soil, under which the soil will dry more steadily and with less tendency to clod formation. Chain harrowing will produce the desired effect, and land so treated will more readily work down to a tilth than it would if left to dry and bake in lumps until the time for final preparation. The crust that sometimes forms when heavy rains follow surface tillage need not be feared, as it is easily reduced by further light harrowing.

The work of tilth formation is best carried out by preparing the land in successive strips, stirring, refining, ridging up, manuring and covering the manure on one strip before proceeding with the next piece of the field. The required depth of mould should be secured by successive operations of gradually increasing penetration.

Last spring I had under particular observation two fields that were being prepared for roots. In one case the land was manured and ploughed during the winter, and in March it received a superficial preliminary stirring. About the end of the month it was gradually refined from the surface downwards with the spring-tooth harrow, then drawn up in ridges to settle: these were later dressed with the chain harrows before sowing with mangolds. The seed came well and the crop, which was liberally fertilised, yielded over 40 tons per acre. In the other case, the spring workings did not begin until April and the first operation was a deep cultivation, which brought up large lumps of damp soil: these baked into clods, which many further workings, aided by dropping weather in May, ultimately reduced to a tilth. The land was ridged up, manured and sown with swedes in May. The swede crop succeeded, yielding about 25 tons per acre, the result being favoured by a wet summer. In a dry May, the plant might have been taken by the fly; but the most obvious result of the error of cultivating deeply at the start was the greatly increased labour of reducing clods, which, as the land was clean, need not have been allowed to form.

**Tilth.**—In the preparation of land for a root crop, the soil is ordinarily reduced to a loose incoherent and comparatively dry mass of particles and groups of particles. This condition is necessary to allow of the extraction of twitch, the incorporation of fertilisers, and the covering of the seed with an appropriate

depth of fine soil. Refining the soil also aerates it and thereby stimulates bacterial activity. A loose incoherent mass is not, however, a favourable rooting ground for crop plants: the best conditions are not attained until the mass of soil has regained a reasonable amount of coherence, having settled and become moist. The necessary moisture rises from the subsoil.

Potatoes are capable of commencing growth in a tilth that is comparatively dry and loose, as the reserve of moisture in the seed may be drawn upon until the soil has become sufficiently settled and moist. Mangolds, however, germinate and come away badly when drilled on such a seed bed. If the land is clean and has been manured and ploughed in good time, the spring preparations for sowing on the flat may be comparatively simple and shallow. It is, in fact, a considerable disadvantage to attempt to break up the land and reduce it to a tilth. This year, many acres will necessarily be manured in the ridge, and seed will be drilled on ridges that have not had the time necessary for them to become settled and moist before sowing. In this case the assistance of the ridge roller will be valuable. Where the ridges can be manured and split a fortnight before sowing, however, it is good practice to dress them with the chain harrows to remove the clods from the tops of the ridges—where they would be a nuisance at singling time—and to expose the moist and somewhat firm soil in which the mangold seed will germinate well.

**Weeds.**—Annual weeds in land intended for roots can be considerably reduced by ridging up and chain harrowing before drilling. The presence of twitch (*Agrostis*), however, complicates the method of preparing the seed bed. On heavy soils it is almost impossible to give infested land a thorough spring cleaning without incurring considerable risk of a reduced mangold crop. Bare fallowing is the favourite method of dealing with this pest, during which series of operations the soil is best kept in rough dry clod until after midsummer. In a wet season such as that of 1924, however, even bare fallowing may fail to clean the land. During the later stages of the war when so much land was in foul condition, many farmers attempted bare fallowing who had little experience of the method, and in some cases the final result was a piece of land in worse condition than it would have been if it had grown a crop of corn.

Twitch is kept down by growing heavy corn crops. During 1919, I observed a good illustration of this principle. A farmer who had about 50 acres of his arable land in such a state as



appeared to necessitate bare fallowing did fallow 40 acres; but in one field, which was as foul as the rest, he decided to try a different plan. During April he skimmed the twitchy layer off, worked it about with fine implements until it was somewhat dry, then ploughed it down under a fairly deep furrow. He then applied a heavy dressing of artificial manures and drilled the field thickly with barley. The barley came up quickly and made a dense cover before the twitch revived. The stubble was found to be remarkably free from the weed. In this case the soil was of fairly strong texture, but I have seen the method adopted with success on light land. Docks apparently cannot be smothered; but Mr. J. C. Brown states that he has been able to suppress thistles by growing two smother crops in succession.

**Live Stock.**—Milk producers contend that in April cows require heavier feeding than in other months to produce the same quantity of milk. There appears to be no experimental evidence in support of this contention, but it is not here disputed. Generally the supplies of succulent food have become rather short, roots have lost some of their digestible contents, and the effects of minor omissions from the diet, such as salt, and mineral deficiencies in the fodder, will have more influence at the end of the winter than at the beginning. Moreover, housed cattle which receive little attention in the matter of grooming often become very uncomfortable owing to skin and hair affections at this time of the year. Cows that have been rather warmly housed during the winter should be gradually hardened during April in anticipation of grass day next month.

While cattle are still indoors the opportunity should be taken to dress their backs to destroy warbles. There are several dressings which if properly applied will kill 80 per cent. or more of the maggots. One that has been very thoroughly tested and found to be both effective against the warble and harmless to the cattle may be prepared by mixing 1 lb. of fresh lime in a gallon of water, adding 4 lb. of tobacco powder, stirring and after standing for 24 hours straining the clear liquid through a cloth. The wash deteriorates on keeping.

April is the month in which the new grazing season begins. Feeding pastures are stocked with large bullocks, dry cows or smaller heifers, according to the known qualities of the respective fields. Dry cows and young cattle other than calves begin to lie out on the second quality pastures during this month, the best dairy pastures being reserved to produce a full bite for the milkers when they begin to lie out in May. Before the

cattle go out the hedges or walls and gates are again looked over and repaired where necessary. Rough old hedges are admittedly best pleached in April while the sap is rising; but the policy of deferring hedge cutting until this month is generally associated with procrastination. Neglected fences are too common a feature of the British countryside, excepting in districts where farming opinion has been cultivated by the activities of local hedge-cutting associations. Some of these societies have accomplished most valuable results.

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## MANURES FOR APRIL.

SIR JOHN RUSSELL, D.Sc., F.R.S.,  
*Rothamsted Experimental Station.*

**Manuring of Swedes.**—The question whether swedes require artificial fertilisers as well as farmyard manure was recently raised at a farmers' meeting. This problem has been made the subject of many field experiments in different parts of the country, and the general result has been that either artificials alone or farmyard manure alone suffice to give crops up to 20 or 25 tons per acre, but a combination of the two gives better results where crops of 30 or 40 tons are obtainable. The growth of swedes is more frequently limited by climatic factors than by fertilisers. In the southern and midland counties, conditions rarely permit of the large crops obtainable in the north of England and in Scotland. In the South Country crops up to the limit of the water supply in the soil can be obtained by the use of some 10 to 12 tons of dung per acre, but only rarely can this be increased by the addition of artificials.

The past season at Rothamsted was very favourable to the growth of swedes, and without artificials the yield amounted to 24 tons per acre. When in addition a liberal dressing of artificials was supplied the yield was pushed up only to 26 or 28 tons according to the dressing; in less favourable years the increases have been smaller. In the numerous seasons in which we have experimented with swedes our crops have varied from 30 tons per acre downwards, but we have not as a rule been able to obtain important additions of crop in good seasons or to save the crop in bad seasons by the addition of artificials to farmyard manure.



A useful mixture of artificials for swedes in the southern and midland counties is composed of 1 cwt. sulphate of ammonia and 4 cwt. superphosphate applied with the seed: as an alternative 10 to 12 tons of dung can be used, but it is not necessary to use both. In the northern counties, where higher yields are obtainable, a combination of both may give good results.

**Does Grazing Grass Respond Best to Slag or Bone?**—This matter has been discussed a good deal, but unfortunately it is not possible to give a definite answer. In the Cockle Park experiments, slag gave the best results both on the lighter and heavier soils, but the land there is a poor Boulder Clay, very different in character from some of the better grass land of the midland counties. The subject is one as to which further tests might well be made.

**Artificial Manures for Hay Land Usually Receiving Dung.**—Among questions recently raised at a farmers' lecture was the following:—Could hay land which normally receives dung, be dressed with nitrate of soda alone in a year when no dung is available? No harm could result to hay land treated in this way. The disadvantages of applying nitrate of soda alone is that it furnishes neither phosphates nor potash, both of which are essential to the grass if the best results are to be obtained. Farmyard manure, however, contains a considerable quantity of potash, 10 tons supplying approximately as much as is present in 3 cwt. of muriate or sulphate of potash. Dung also contains phosphate, though as a rule not sufficient for the best development of the herbage. Good results can be expected from the occasional use of basic slag in autumn, followed by nitrate of soda in spring. If farmyard manure has not been given for some time, a dressing of kainit is commonly advantageous in supplying the needful potash and thus ensuring adequate development of the clover.

**The Use of Nitrogenous Fertilisers on Pasture Land.**—Considerable interest is being taken in the question whether sulphate of ammonia or nitrate of soda should be applied to grazing land. At present the only experimental evidence is that furnished by Cockle Park, and this is not direct evidence but is based on the feeding value of hay from mown land. It is there shown that sulphate of ammonia used alone increased the yield of hay from 19 to 23 cwt. per acre, but it depressed the value of the hay as shown by the feeding results from 80s. to 72s. per ton: the net result was a financial loss of 14s. 5d. per acre. A similar depression in money value was obtained when slag was given in addition.

Slag alone yielded  $25\frac{1}{4}$  cwt. per acre, valued on the basis of feeding trials at 93s. per ton, while slag and sulphate of ammonia gave  $29\frac{3}{4}$  cwt. per acre valued at 24s. per ton; the profit from the slag was 31s. per acre, and from the slag and sulphate of ammonia 17s. 2d. However, grass land differing from that at Cockle Park might well respond differently, and the subject is one on which more experiments are needed before an answer can be given.

**Ploughing in of Green Crops.**—An interesting result was obtained at Rothamsted last year showing the increased yield obtained by ploughing green crops into the soil before sowing cereals. Mustard had been grown in the late summer of 1923; the crop was ploughed in just before the sowing of oats in October; the yields of oats in August, 1924, were as follows:—

	<i>Bushels per Acre.</i>		
	No other Manure.	5 tons Town Refuse.	10 tons Town Refuse.
Green Manure (Mustard) ...	43.3	51.8	48.8
No Green Manure ...	27.5	29.3	32.8
Balance in favour of Green Manuring ... ..	15.8	22.5	16.0

There was thus an increase of 16 bushels obtained in two tests, and  $22\frac{1}{2}$  bushels in the third as the result of ploughing in the green crop. The cost of the green crop is not great, and its effect is very striking; a dressing of farmyard manure could hardly have been expected to do better. It is rarely possible to treat much land in this way, but no opportunity should be neglected. Mustard is nearly always suitable: vetches are good in a heavy soil but not in a light one.

## MONTHLY NOTES ON FEEDING STUFFS.

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**The Purchase of Feeding Stuffs for Milk Production.**—In constructing a balanced ration for feeding dairy cows, the home-grown feeding stuffs generally supply all the carbohydrates or fats required, but the protein supply is generally deficient. The main reason why the dairy farmer purchases feeding stuffs is to obtain the extra protein the animal requires for milk production, and he therefore requires to know, not simply how much starch equivalent they supply, but how much digestible protein they supply and its relative cost. In order to enable the dairy farmer to compare the relative values of foods from a



DESCRIPTION.	Price per Qr.		Price per Ton.	Manurial Value per Ton.		Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.	Percent of Digest. Crude Protein %
	s. d.	lb.		£ s.	£ s.					
Wheat, British -	—	—	13 13	0 16	12 17	71·6	3/7	1·92	10·2	
Barley, British Feeding	—	—	10 15	0 12	10 3	71	2/10	1·52	6·5	
" Canadian :—										
No. 3 Western	41/9	400	11 13	0 12	11 1	71	3/1	1·65	6·5	
" 4 " -	40/9	"	11 8	0 12	10 16	71	3/1	1·65	6·5	
" American	40/9	"	11 8	0 12	10 16	71	3/1	1·65	6·5	
" Danubian	40/9	"	11 8	0 12	10 16	71	3/1	1·65	6·5	
" Karachi -	41/0	"	11 10*	0 12	10 18	71	3/1	1·65	6·5	
Oats, English, White	—	—	10 0	0 13	9 7	59·5	3/2	1·70	8·0	
" " Black and Grey	—	—	9 13	0 13	9 0	59·5	3/0	1·61	8·0	
" Scotch White	—	—	11 0	0 13	10 7	59·5	3/6	1·87	8·0	
" Canadian :—										
No. 2 Western	35/3	320	12 7	0 13	11 14	59·5	3/11	2·10	8·0	
Argentine	29/0	"	10 3	0 13	9 10	59·5	3/2	1·70	8·0	
Maize, Argentine -	42/6	480	9 18	0 13	9 5	81	2/3	1·20	7·1	
Beans, English Winter	—	—	11 5	1 12	9 13	67	2/11	1·56	20·1	
" Chinese	—	—	11 15	1 12	10 3	67	3/-	1·61	20·1	
Peas, English Maple	—	—	11 7	1 8	9 19	69	2/11	1·56	19·4	
" Japanese -	—	—	24 5†	1 8	22 17	69	6/7	3·53	19·4	
Rye, Homegrown -	—	—	11 0	0 16	10 4	71·6	2/10	1·52	9·6	
Dari, Egyptian -	—	—	10 17	0 15	10 2	75·2	2/8	1·43	7·7	
" Persian -	—	—	12 10	0 15	11 15	75·2	3/2	1·70	7·7	
Millers' Offals :—										
Bran, British -	—	—	8 2	1 7	6 15	45	3/0	1·61	10·9	
" Broad -	—	—	9 15	1 7	8 8	45	3/9	2·01	10·9	
Middlings—										
Fine Imported	—	—	9 15	1 2	8 13	72	2/5	1·29	12·6	
Coarse, British	—	—	8 5	1 2	7 3	64	2/3	1·20	11·5	
Pollards, Imported -	—	—	7 15	1 7	6 8	60	2/2	1·16	11·6	
Meal, Barley -	—	—	13 0	0 12	12 8	71	3/6	1·87	6·5	
" Maize -	—	—	11 12	0 13	10 19	81	2/8	1·43	7·1	
" " South African	—	—	10 12†	0 13	9 19	81	2/5	1·29	7·1	
" " Germ -	—	—	10 5	0 19	9 6	85·3	2/2	1·16	18·4	
" " Gluten Feed	—	—	11 0	1 7	9 13	75·6	2/7	1·38	20·0	
" Locust Bean	—	—	9 15	0 9	9 6	71·4	2/7	1·38	4·0	
" Bean -	—	—	13 5	1 12	11 13	67	3/6	1·87	20·1	
" Fish -	—	—	21 0	4 7	16 13	53	6/3	3·35	50·0	
Linseed -	—	—	24 10	1 11	22 19	119	3/10	2·05	19·4	
" Cake, English										
12% Oil	—	—	14 5	1 18	12 7	74	3/4	1·78	25·3	
" 10% Oil	—	—	13 10	1 18	11 12	74	3/2	1·70	25·3	
" 9% Oil	—	—	13 5	1 18	11 7	74	3/1	1·65	25·3	
Soya Bean Cake 6% Oil	—	—	12 0	2 14	9 6	69	2/8	1·43	38·2	
Cottonseed Cake, English										
5½% Oil	—	—	8 0	1 15	6	42	3/0	1·61	17·6	
" " Egyptian										
5½% Oil	—	—	7 12	1 15	5 17	42	2/9	1·47	17·6	
Decorticated Cotton										
Seed Meal 7% Oil -	—	—	12 0	2 14	9 6	74	2/6	1·34	36·3	
Ground Nut Cake 7% Oil	—	—	10 17*	1 16	9 1	56·8	3/2	1·70	42·0	
Palm Kernel Cake 6% Oil	—	—	9 10†	1 3	8 7	75	2/3	1·20	17·1	
" " Meal 2% Oil	—	—	8 7	1 4	7 3	71·3	2/-	1·07	17·1	
Feeding Treacle -	—	—	7 10	0 8	7 2	51	2/9	1·47	1·1	
Brewers' Grains :—										
Dried Ale -	—	—	9 17	1 4	8 13	49	3/6	1·87	14·0	
" Porter -	—	—	9 7	1 4	8 3	49	3/4	1·78	14·0	
Wet Ale -	—	—	1 12	0 9	1 3	15	1/6	0·80	4·8	
" Porter -	—	—	1 7	0 9	0 18	15	1/2	0·62	4·8	
Malt Culms -	—	—	8 10†	1 14	6 16	43	3/2	1·70	19·9	

\* At Bristol. † At Liverpool. ‡ At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of January and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton. The manurial value is £1 3s. per ton. The food value per ton is therefore £8 17s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s.; P<sub>2</sub>O<sub>5</sub>, 4s. 2d. O<sub>2</sub>, 2s. 6d.

protein-supplying standpoint, a new column has been included in the feeding stuffs table giving the percentage of digestible protein present in the feeding stuffs. By dividing the price per ton of the feeding stuffs by the percentage of digestible protein present, the farmer is enabled to ascertain in a rough and ready way the cheapest foods regarded as sources of supply of protein.

**Milk Yield of Cows as Affected by Times of Milking.**—Much discussion always arises when the subject of the advantages of frequent milking of cows is mentioned to dairy farmers. The general custom is to milk twice daily, but occasionally dairy farmers, particularly when dealing with heavy yielding cows, will milk three times a day or more. The advocates of frequent milking state that the total milk yield of the cows is increased materially by increasing the number of times of milking. An interesting study on this subject has been carried out at Missouri University by Ragsdale, Turner and Brody. In their experiments, which were extended over a period of three months, they used two Jersey and two Ayrshire cows. As the result of their observations, the conclusion arrived at was that a cow that is milked three times daily will give 110 per cent. of the milk that is given by the cow milked twice daily. If the number of times of milking is increased to four times a day, the yield will be increased to 116 per cent. Thus, on this basis, a cow giving 10 quarts of milk a day when milked twice daily will give 11 quarts if milked three times a day, and 11.6 quarts if milked four times a day. The results of this experiment indicate that where labour conditions can be adjusted to the new routine, milking three or even four times a day will be followed by beneficial results. In a herd giving 100 gallons of milk a day an extra 10 gallons a day is worth striving for.

**The Influence of Fats in Feeding Stuff.**—In making up rations for animals, a point that is often overlooked is the amount of fat that is given in the ration. Experiments with adult ruminants showed that an increase of the fat beyond 1 lb. per 1,000 lb. live weight is likely to lead to disturbance of digestion, and the appetite also is likely to be affected. Rice bran is particularly rich in oil, samples often containing as much as 13-14 per cent. of fat, and care should always be exercised in rations including this material, to ensure that the maximum desirable amount of oil is not exceeded. With growing stock and young animals, and also with pigs, up to 2 lb. of fat per 1,000 lb. live weight can be given without any detrimental effect.



## FARM VALUES.

CROPS.	Market	Value	Starch Equivalent per 100 lb.	Food Value per Ton.	Manurial Value per Ton.	Value per Ton on Farm.
	Value per	per				
	lb. S.E. d.	unit S.E. s. d.				
Wheat - - - -	1.20	2 3	71.6	8 1	0 16	8 17
Oats - - - -	1.20	2 3	59.5	6 14	0 13	7 7
Barley - - - -	1.20	2 3	71.0	8 0	0 12	8 12
Potatoes - - - -	1.20	2 3	18.0	2 1	0 4	2 5
Swedes - - - -	1.20	2 3	7.0	0 16	0 2	0 18
Mangolds - - - -	1.20	2 3	6.0	0 14	0 3	0 17
Beans - - - -	1.20	2 3	67.0	7 11	1 12	9 3
Milk - - - -			17.1			
Good Meadow Hay - - -	1.87	3 6	31.0	5 8	0 14	6 2
Good Oat Straw - - -	1.87	3 6	17.0	2 19	0 7	3 6
Good Clover Hay - - -	1.87	3 6	32.0	5 12	1 0	6 12
Vetch and Oat Silage - -	1.52	2 10	14.0	2 0	0 7	2 7
Barley Straw - - -	1.87	3 6	19.5	3 8	0 6	3 14
Wheat Straw - - -	1.87	3 6	11.0	1 18	0 4	2 2
Bean Straw - - -	1.87	3 6	19.0	3 6	0 9	3 15

## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending March 11th.					Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn		
	£ s.	£ s.	£ s.	£ s.	s. d.	
Nitrate of Soda (N. 15½ per cent.) ... ..	14. 0	13.17	13. 0	13. 9	17. 4	
" " Lime (N. 13 per cent.) ... ..	...	12.10	...	12.12	19. 5	
Sulphate of Ammonia, ordinary (N. 20.7 per cent.)	13.11*	13.11*	13.11*	13.11*	(N)13.1	
" " " neutral (N. 21.1 per cent.)	14 14*	14.14*	14.14*	14.14*	(N)13.11	
French Kainit (Pot. 20 per cent.) ... ..	3.0	3. 0	...	2.12	2. 7	
" " (Pot. 14 per cent.) ... ..	2.15	2.15	2. 7	2. 7	3. 5	
Potash Salts (Pot. 30 per cent.) ... ..	...	...	3.17	3.15	2. 6	
" " (Pot. 20 per cent.) ... ..	...	...	2.17	2.10	2. 6	
Muriate of Potash (Pot. 50 per cent.) ... ..	8.5	7.10	7. 5	7. 0	2.10	
Sulphate of Potash (Pot. 48 per cent.) ... ..	12.10	11.15	11.10	11.10	4. 9	
Basic Slag (T.P. 30 per cent.) ... ..	3. 2§	...	2.12§	2.12§	1. 9	
" " (T.P. 28 per cent.) ... ..	...	2. 1†	...	2.10§	1.10	
" " (T.P. 26 per cent.) ... ..	...	1.14†	...	2. 8§	1.10	
" " (T.P. 24 per cent.) ... ..	...	1.11†	2. 0§	2. 6§	1.11	
Superphosphate (S.P. 35 per cent.) ... ..	...	...	3.15	3. 8	1.11	
" (S.P. 30 per cent.) ... ..	3. 7	3. 5	3. 8	3. 2	2. 1	
Bone Meal (N. 3¼, T.P. 45 per cent.) ... ..	9.10	8.10	8.10	8. 5	...	
Steamed Bone Flour (N. ¾, T.P. 60 per cent.) ... ..	7. 0†	7. 7†	6.10	6. 7†	...	
Fish Guano (N. 7½-8¼, T.P. 16-20 per cent.) ... ..	...	...	13. 0	...	...	
" " (N. 9, T.P. 10 per cent.) ... ..	...	...	...	12.10	...	
Burnt Lump Lime ... ..	1. 8	1.17	1.18	2. 2§	...	
Ground Lime ... ..	1.14	2. 7	2. 8	1.16§	...	
Ground Limestone ... ..	1. 1	...	1. 4	1. 5§	...	

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ F.o.r. Works.

§ Prices include cost of carriage from works to town named, and at London are for not less than 4-ton lots. Cost to purchasers in other districts will be greater or less according to the distances of different purchasers from the works.

## MISCELLANEOUS NOTES.

Two clean milk competitions, each covering a wide area in the north of England, were held in 1924. One of them, covering the three Ridings of Yorkshire, was organised by the Yorkshire Agricultural Society in co-operation with the Yorkshire Council for Agricultural Education. The other was organised by Armstrong College, Newcastle-on-Tyne, in conjunction with the Local Education Authorities of the four counties concerned, viz., Cumberland, Durham, Northumberland and Westmorland.

### **Clean Milk Competitions in the North of England.**

*Yorkshire Competition.*—The Yorkshire competition, which attracted 18 entries, extended over a period of four months, commencing on 14th February and ending on 14th June, 1924, thus including two cold and two warmer months; and prior to its commencement, arrangements were made for two members of the University Staff to visit and advise competitors as to the methods necessary for clean milk production. Twelve competitors availed themselves of the offer.

The system of awarding marks was similar to that detailed in the Ministry's Guide\* and included inspection on the farm and the examination of milk for bacteria, keeping qualities, and fat content. Eight samples of milk were taken from each competitor, seven samples of morning's milk being submitted by competitors themselves and one surprise sample of afternoon's milk being taken by the inspecting judge on the occasion of his official visit. Generally there was a very close agreement between the bacterial counts of the competitor's own samples, and that of the surprise sample. In regard to the testing of these samples it is of considerable interest to note that 5 competitors out of 18 had 100 per cent. of their samples within the standard laid down for Grade A milk, 4 competitors 87.5 per cent., 1 competitor 75 per cent., and 4 competitors 62.5 per cent. In addition, of the total samples submitted, 77.2 per cent. reached the standard required for Grade A milk, and the average sample kept perfectly sweet and untainted for  $3\frac{1}{2}$  days. These figures demonstrate that the competition was effective in educating the competitors in the meaning and value of clean methods.

A Challenge Cup provided by the Olympia Oil and Cake Co., Ltd. was awarded. This cup has to be won three times including twice in succession to become the personal property of the

\* *Miscellaneous Publications*, No. 43, "Guide to the Conduct of Clean Milk Competitions," price 6d. net, post free.



winner. In addition, certificates were given to six competitors and their regular milkers who reached a sufficiently high standard. Money prizes were given to the employees on the farms of the leading four competitors.

This competition, in common with others held in different parts of the country, serves to confirm the view that in the production of clean milk, methods are of more importance than expensive buildings and elaborate machinery. It shows that the chief essential is attention to detail, until a satisfactory routine of clean methods has been established; and, further, that an intelligent interest must be shown by farmers and their employees.

*Four Northern Counties Competition.*—In the case of the Armstrong College competition, a series of clean milk demonstrations on farms had been given previously. It was found that this work was fruitful in producing a much better understanding of the essential conditions for clean milk production. The competition commenced on 1st March, 1924, and lasted five months. There were 40 competitors (Northumberland 17, Cumberland 17, Westmorland 4 and Durham 2) and this number would undoubtedly have been much greater had it not been for serious outbreaks of foot-and-mouth disease in the area shortly before the competition commenced.

The awards were based on a scale of points approximating that subsequently recommended in the Ministry's Guide, attention being given to the bacterial and chemical composition of the milk, the general health of cows, methods of milking and general management, and the condition of byres and buildings so far as they were directly under the control of the competitor. Competitors were required to send to Armstrong College samples of milk for bacteriological and chemical examination on request; such requests were sent at irregular intervals and only short notice was given. Each farm was visited at least twice, and in most cases three times, by the inspecting judges, and on these occasions surprise samples of milk were taken.

249 samples were examined of which 166 were submitted by farmers and 83 were taken by the inspecting judges. From the following statement it will be seen that more than half the samples submitted were of a standard above Grade A.

<i>Standard Reached.</i>	<i>Number of Samples.</i>	<i>Percentage.</i>
Certified ... ..	90	36.14
Grade A ... ..	49	19.67
Below Grade A ... ..	110	44.17

A Challenge Cup was awarded to the winner of the competition and a silver medal to the second competitor. Two competitors were placed equal for the third place, each of them receiving a bronze medal. Certificates were awarded to the ten leading competitors, whose work reached an exceedingly good standard. Printed recognitions were given to the workers on these farms, and money prizes were awarded to the employees on the four prize-winning farms. The prizes to farmers and certificates to workers were given by the National Milk Publicity Council.

In the reports on the competition it is stated that whilst with few exceptions the methods employed by the competitors at the beginning of the competition were not good, many improvements were noticed when the final inspections were made. Milking machines were in use on three farms, but in no case were the results so satisfactory as on those farms where clean hand-milking was practised. It is again reiterated that it was only on these farms where not only were the buildings clean, and the utensils properly sterilised, but where the milkers were all keen and painstaking in their methods, that good results were obtained: and that whilst the importance of suitable cow-houses and buildings must not be under-estimated, milk up to the standard of Certified Milk was produced on farms where the buildings must be classed as inferior.

Full reports on both these competitions have been issued: (1) "Clean Milk in Yorkshire," by the Yorkshire Agricultural Society, and (2) "Clean Milk Competition, 1924," by the Agricultural Department of Armstrong College. These reports are very full and instructive, and a wide distribution has been made. That they have aroused considerable interest is evidenced by the generally expressed desire that further competitions should be held in 1925, and arrangements are in hand for the movement to be continued and extended.

\* \* \* \* \*

The general level of the prices of agricultural produce during February was 67 per cent. above those ruling in the corresponding month of 1911-13. The index

#### The Agricultural Index Number.

number therefore shows a decline of 3 points as compared with January, but is 6 points higher than in February of last year. The rise as compared with last year is due to wheat, barley, sheep and pigs, most other commodities being cheaper now than a year ago.



In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.	1924.	1925
January ...	200	183	75	68	61	70
February ...	195	167	79	63	61	67
March ...	189	150	77	59	57	—
April ...	202	149	70	54	53	—
May ...	180	119	71	54	56	—
June ...	175	112	68	51	58	—
July ...	186	112	72	53	52	—
August ...	193	131	67	54	59	—
September	202	116	57	56	60	—
October ...	194	86	59	51	63	—
November	193	79	62	53	64	—
December	184	76	59	56	63	—

Wheat averaged 8d. per cwt. more than in January, and the index figure advanced to 83 per cent. above pre-war, so that wheat was relatively the dearest grain and was making comparatively higher prices than most other commodities. Barley prices dropped sharply, though the decline would be occasioned to some extent by a larger proportion of the sales being of feeding qualities. Oats were slightly dearer than in January, but the rise was relatively smaller than in the basic years and the index figure was reduced by 4 points.

All classes of fat stock sold at higher rates on the month, but the rise of  $\frac{1}{2}$ d. per lb. in the case of sheep was not so sharp as in pre-war years and the index number for these declined. The advance in fat cattle was 3d. per 14 lbs. stone, while bacon pigs rose by 7d. per stone and porkers by 4d. per stone. The index figure for fat pigs has risen each month since July, 1924, and is now 61 per cent. above 1911-13 against only 31 per cent. eight months ago.

The demand for dairy cattle has not been brisk, as the mild weather has conduced to the flow of milk being well maintained, and on the average cows sold at about 15s. per head less than in January. All classes of store stock became dearer last month, but the rise in pigs and sheep was relatively not quite so large as in 1911-13.

Butter averaged 2d. per lb. less than in January, and was  $1\frac{1}{4}$ d. per lb. cheaper than in February, 1924. Eggs also realised less money than a year ago, the decline in February being much sharper than last year and in the basic years, and the index number fell by 20 points. Cheese was 2s. 6d.

per cwt. dearer than in January, but the index number rose by 1 point only. Milk was unchanged on the month.

Prices of potatoes became rather easier during February, the average fall being about 5s. per ton, and for the first time for many months the index number is lower than a year earlier. The index number of other vegetables declined by 7 points to 74 per cent. above pre-war. Carrots remained very cheap at 27 per cent. above 1911-13, and cabbage declined on the month to only 40 per cent. above pre-war. Celery remained unchanged at rather over double the price in the basic years, and cauliflowers, though 5d. per dozen cheaper than in January were  $2\frac{1}{4}$  times the pre-war price. Brussels sprouts advanced by 1s. 2d. per cwt. and at 62 per cent. above 1911-13 were 11 points up on the month, and onions rose sharply to 81 per cent. above the price in the basic years.

Index numbers of different commodities during recent months and in February, 1923 and 1924, are shown below:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1923.	1924.			1925.	
	Feb.	Feb.	Nov.	Dec.	Jan.	Feb.
Wheat ...	28	44	68	67	76	83
Barley ...	12	43	89	76	81	59
Oats ...	39	41	45	37	46	42
Fat cattle ...	61	54	47	44	52	53
Fat sheep ...	97	75	90	84	107	100
Fat pigs ...	88	34	45	49	59	61
Dairy cows ...	67	48	60	55	53	50
Store cattle ...	36	39	36	37	43	46
Store sheep ...	100	89	94	85	102	100
Store pigs ...	154	50	33	38	49	48
Eggs...	46	75	84	51	82	62
Poultry ...	80	52	62	64	63	56
Milk ...	90	87	82	84	84	84
Butter ...	72	71	74	73	73	62
Cheese ...	88	72	38	51	49	50
Potatoes ...	—5*	170	168	166	152	144
Hay ...	42	—1*	1	2	1	0

\* Decrease.

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THE Ministry announces that owing to the increasing number of poultry submitted to the Ministry's Veterinary Laboratory for post-mortem or other examination, it has been found necessary to appoint a special officer to undertake this examination work. It has also been decided to institute a scale of fees to be charged as from 16th March last.

**Veterinary  
Tests for  
Poultry Diseases.**

The charge for an ordinary post-mortem examination will be 8s. a bird. In the case of flocks suspected of being infected with Bacillary White Diarrhoea, an inclusive fee of 10s. is payable, in respect of whatever number of tests are required to establish, or otherwise, the existence of the disease in the flock. In all cases where a number of chicks have died it is desirable that several should be sent for examination. In flocks where this disease is found the remaining birds will be tested for elimination purposes at an additional fee of 1s. a bird. In all cases fees are payable in advance.

Special terms will be allowed where birds are submitted in numbers (*e.g.*, from egg-laying competitions) for post-mortem examination or for the agglutination test for bacillary white diarrhoea. Particulars may be obtained from the Ministry's Veterinary Laboratory, New Haw, Weybridge. (Station: Addlestone, S.R.). Birds submitted for post-mortem or other examination should be sent direct to that address, carriage paid, accompanied by the necessary remittance, and accompanied by the name and address of the sender. Postal orders, etc., should be made payable to "The Ministry of Agriculture and Fisheries" and crossed "& Co."

\* \* \* \* \*

ARTICLE 6 of the Canadian Seed Importation Regulations, which was in operation up to 1st October, 1924, provided that

**Amendment of  
the Canadian  
Seed Importation  
Regulations.**

shipments of seeds marked with a grade, or, in the case of field root and garden vegetable seeds, with the percentage of germination, might be released by the Collector of Customs without delay if a Canadian Government Seed Laboratory test number was given as authority for grade or percentage of germination stated. It is understood that few importers availed themselves of the facilities for getting a Canadian test made before shipment, so that, in most cases, imported lots had to be held up by the Customs until an official test was completed. The delay in the delivery of imported seeds caused in this way, is said to have

seriously handicapped business, and in order to meet these difficulties the Canadian authorities have now amended Article 6 to read:—

“Delivery without examination or bond.—The Collector of Customs may, after taking a sample for test, deliver shipments of seed to consignees without further examination or bond: (1) when the invoices are accompanied by a certificate issued by an official seed testing station, of any country or state, which official seed testing station has been approved by either the Association of Official Seed Analysts of North America or the International Seed Testing Association, showing the percentage of pure living seed and the proportion of weed seed to conform to the minimum standards required for the kind of seed under the Seeds Act and regulations; or, (2) when the invoices or containers are marked with a control sample certificate number from a Canadian seed inspection office showing that the seed conforms to the minimum standards required for the kind of seed under the Seeds Act and regulations, and including: (a) for seed imported under grade, the name of the grade of seed and the serial number of the certificate; (b) for seeds of rape, field roots and garden vegetables, the serial number of the control sample certificate.

“The privilege hereby extended of delivering seed without examination or bond may be withdrawn at any time by the Minister if the imported seed does not within the limits of reasonable variation conform to the control sample that is held by the official seed testing station which issued the certificate that is attached to the invoice or container.”

The Seed Testing Stations in Europe whose tests are valid for the purpose of this regulation are as follows: England (Cambridge); Scotland (Edinburgh); Ireland (Dublin, Belfast); Denmark (Copenhagen); Norway (Trondhjem); Sweden (Orebro); Germany (Hamburg, Munich, Breslau); Holland (Wageningen); Belgium (Louvain); France (Paris); Switzerland (Zurich); Austria (Vienna); Czecho-Slovakia (Prague); Hungary (Budapest); Roumania (Bukarest); Italy (Bologna); Finland (Helsingfors).

\* \* \* \* \*

LAST year the Ministry arranged, through the Agricultural Commissioner of the Danish Government, for a limited number of

**Exchange of  
British and Danish  
Agriculturists.**

young agriculturists from this country who were desirous of securing practical experience of Danish agriculture, to be placed for work on farms in Denmark. Similarly, arrangements were made for an equal number of young agriculturists from Denmark to be placed on farms in this country. Approved applicants were required to pay their own travelling expenses to and from their destination, and to undertake regular work on a farm, for a period of from three to six months, in return for free board and lodging. No money was payable to them.



On the whole the scheme worked satisfactorily, and it has therefore been decided to continue it, on the same lines, during 1925. The National Farmers' Union is giving assistance in the selection of farms where Danish agriculturists may be received, and in securing suitable British applicants for placing on Danish farms. Applications from young agriculturists in this country may be sent to the Ministry of Agriculture, and will be transmitted to the Danish Agricultural Commissioner.

\* \* \* \* \*

It will be remembered that in December last the Ministry felt it necessary to prohibit the importation into England and Wales

**Prohibition of  
Importation  
of Potatoes  
from Canada.**

of potatoes grown in the United States in order to guard against the importation into this country of the destructive Colorado Beetle with which the potato fields over large areas of the States are infested. It was recognised at the time that consideration would have to be given to the necessity for similar action in regard to potatoes grown in Canada, and inquiries were accordingly made as to the prevalence of the Colorado Beetle in the potato-growing districts of the Dominion. It appears as a result of these inquiries that the continued importation of Canadian potatoes involves a risk of the introduction of the beetle into this country, and the Ministry has accordingly issued the Colorado Beetle Order of 1925 prohibiting the importation into England and Wales of potatoes grown in Canada. The Order came into operation on 20th February, but provision was made for the admission of any consignments shipped before that date.

\* \* \* \* \*

THE Ministry has recently undertaken to test a special method of vaccination of animals against tuberculosis. The vaccine used

**Vaccination of  
Animals against  
Tuberculosis.**

in the test is the result of many years of work by two distinguished scientists, Dr. Calmette and M. Guérin. It is not claimed by them that the vaccine is an effective preventive, but merely that the promise of preliminary experiments entitles it to a trial in the field of practice—a trial which is unlikely to be completed in less than five years. The Ministry does not hesitate to say that it is unable at present to encourage those farmers who are at the present time considering the use of a vaccine in the belief that a solution of the problem has been reached. With regard to the trials conducted by the Ministry, the material for the vaccine costs only a few pence

per dose, and is being issued, in those cases which are selected for trial, free of charge.

These facts should be borne in mind by stock-owners, should they be recommended to use any vaccines against tuberculosis which have not been fully tested out in practice. In this connection, it should be remembered that all attempts in the past to immunise animals against tuberculosis with killed bacilli have definitely failed in their purpose. The Calmette-Guerin vaccine which the Ministry is trying out is a living one.

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THE Ministry's attention has been drawn to a striking illustration of the value of running poultry on poor pastures on light soils.

**Poultry for  
Improving  
Poor Pastures on  
Light Soils.**

This occurred on a manorial demonstration plot which was one of a series arranged by the Agricultural Education Sub-Committee of the Worcestershire County Council. The soil consisted of sandy to gravelly loam over a sandy to gravelly subsoil. The turf was comparatively young and the chief grass hard fescue with, mainly, bent, Yorkshire fog and sweet vernal; cocksfoot and perennial ryegrass were also present. The leguminous species included minute plants of white clover and narrow-leaved vetch. Composite weeds were abundant and also mouse-ear chickweed, sorrel and moss. At one end of the field a large flock of poultry with free range has been fed for two seasons. The change which has been effected in the composition of this rather singular type of mixed herbage has been remarkable. Where the poultry congregated most, white clover has increased to such an extent that it has almost blotted out all other plants. A diminishing effect is observable as the range widened. In this way, a good method of improving poor pastures on light soils has been strikingly demonstrated at this centre which is well worth consideration in other suitable cases.

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A SCHEME has been in operation in the early part of the year for several seasons now to assist county education authorities

**Egg and Chick  
Distribution  
Scheme, 1925.**

in the distribution of sittings of eggs and day-old chicks, with the object of improving the breed of poultry kept by the smaller poultry-keepers and cottagers in rural districts.

The main points of the scheme are the approval and regular inspection of stations from which sittings of eggs and day-old chicks at a specified and moderate price are supplied to applicants



resident within the county. The owners of these approved stations, called "station-holders," are appointed for the season and receive a small subsidy in addition to the price for eggs or chicks paid by the purchaser. It is a condition that the poultry stock at the station shall consist of pure-bred birds of good utility quality, and it is the duty of the County Poultry Instructor to select the stock of a station and to mark it. When the station has been approved, the management of the birds and the manner in which the work of distribution of eggs and chicks is carried out are put under the general supervision of the County Poultry Instructor.

The prices fixed by county education authorities for sittings of eggs now range between 3s. 6d. and 7s. a dozen, and for day-old chicks, 7s. to 14s., with an additional charge for carriage and box when sent by rail or post. In order to encourage a higher standard of stock at the stations this year, higher prices and premiums than in previous years are being allowed for eggs and chicks from selected trap-nested hens. The details of the prices and premiums are as follows:—

(a) *Non-trap-nested Stock*.—3s. 6d. to 5s. per dozen eggs, 7s. to 10s. per dozen chicks and ducklings. Premiums: 1s. 6d. per dozen eggs, 3s. per dozen chicks or ducklings.

(b) *Trap-nested Stock*.—5s. to 7s. per dozen eggs, 10s. to 14s. per dozen chicks and ducklings. Premiums: 2s. 6d. per dozen eggs, 5s. per dozen chicks or ducklings.

The station-holders are recognised under either (a) or (b), but not under both. The season for the distribution of sittings of eggs will last up to 30th April and for chicks up to 15th May.

It is interesting to record the increasing popularity of this scheme. Taking the last six completed years, the figures show that the number of stations has increased from 163 in 1919 to 316 last year, whilst the number of eggs has increased from 52,980 in 1919 to 107,960 in 1924, and the number of chicks from 2,974 in 1919 to over 49,000 in 1924. Orders for eggs and chickens, together with the necessary remittance, should be sent direct to a station-holder. The addresses of station-holders, together with full particulars of the county scheme, may be obtained on application to the Agricultural Organiser in those counties which have adopted the scheme. No doubt those requiring eggs or chicks will see to it that they send to the nearest station-holder and will give their full names, addresses, and nearest railway station. They should always endeavour to arrange for delivery by hand if possible, in order to avoid risk of delay or rough handling in transit.

THE Ministry has suggested to local education authorities that a system of demonstration work which is now undertaken in a few counties might, with advantage, be extended to all. These demonstrations are designed simply to exhibit the best modern practice, in one definite matter and on a fairly large scale, to farmers in a district where that practice is not known, or at least not generally adopted. The demonstrations would thus be limited to certain specific points which can be brought out clearly and without risk of confusion. Such questions, for example, as the application of North African phosphate, or an increased application of certain artificial manures, to arable land, or the use of improved seeds mixtures in pastures, or of improved varieties of wheat, oats, barley, etc., or the spraying of charlock could, it is thought, be taken up with very considerable advantage, particularly in the more backward districts. It will be especially useful if in those cases where merely a change of practice is to be demonstrated, the ordinary practice can also be shown side by side with the new practice. Where possible, all demonstrations in one county will be shown on the same farm.

It is understood that the suggested extension of this type of demonstration work, either in place of, or supplementary to, the existing county demonstrations and experiments, is being considered with favour in many counties.

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A MEETING of the Agricultural Wages Board was held on 10th March, at Gwydyr House Annexe, Whitehall, S.W.1, the

**Farm Workers' Minimum Wages.** Chairman, Lord Kenyon, presiding. The Board considered notifications from various Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages, and proceeded to make the necessary Orders carrying out the Committees' decisions, and specifying the date from which the rates should become effective; the date specified being 16th March in each case (except where otherwise mentioned below).

The rates thus fixed are, in the case of male workers 21 years of age and over, as follows:—

*Cornwall.*—For nine months, 31s. for 51 hr. Overtime at 9d. per hr. on weekdays and 10d. per hr. on Sundays.

*Devon.*—For three months, 32s. 6d. for 50 hr. Overtime at 8½d. per hr. on weekdays and 10d. per hr. on Sundays. (The operation of the overtime rates is deferred until the Committee have defined overtime employment.)



*Lancashire: Southern Area.*—Stockmen and teamsmen, 37s. for 52½ hr.; other adult male workers, 33s. 6d. for 50 hr.

*Eastern Area.*—42s. for 60 hr.

*Northern Area.*—Stockmen and teamsmen, 40s. for 60 hr.; other adult male workers, 37s. 6d. for 60 hr. Overtime in each area 1s. per hr.

*Monmouth.*—For twelve months, 32s. for 50 hr. in summer (first Monday in March to the day before first Monday in Nov.) and 48 hr. in winter (the remainder of the year). Overtime at 9½d. per hr. on weekdays and 11½d. per hr. on Sundays.

*Northumberland.*—Until 12th May, 1926, stewards, horsemen, cattlemen, stockmen or shepherds hired by the week or longer, 41s. for customary hr. in the case of such workers who are householders, and 38s. for workers who are not householders. (A week of customary hr. is defined as meaning not exceeding 62 hr.) Other male workers (except casual workers), 34s. for 48 hr. in winter (the Monday following the last Sunday in Oct. up to the Sunday previous to the first Monday in March), and 52½ hr. in summer (the remainder of the year). Male casual workers, 7½d. per hr. Overtime (except for casual workers), weekdays at time-and-a-quarter, Sundays at time-and-a-half.

*Somerset.*—Until 29th September, 1925, 32s. for 52 hr.

*Carmarthen.*—Until 14th Nov., 1925, 30s. for a seven day week of 54 hr., with overtime at 8½d. per hr.

*Glamorgan.*—Until 1st March, 1926, 37s. 6d. for 53 hr. in summer (1st March to 31st Oct.) and 51 hr. in winter (the remainder of the year). Overtime at 10d. per hr. weekdays and 11d. per hr. Sundays.

The above 8 Orders complete the bringing into operation under the Agricultural Wages (Regulation) Act, 1924, of minimum rates of wages for all classes of male workers employed in agriculture throughout England and Wales, the rates for the areas of the other 39 Agricultural Wages Committees being already in force.

The above Orders all include minimum rates for male workers under the age of 21, and also, except in the case of Somerset, for female workers. The principal rates for female workers are:—

*Cornwall.*—Aged 20 and over, 5d. per hr.

*Devon.*—Aged 20 and over, 5d. per hr.

*Lancashire.*—Aged 18 and over, 6d. per hr.

*Monmouth.*—Aged 17 and over, 6d. per hr.

*Northumberland.*—Aged 18 and over, other than casual workers, 5d. per hr.; casual workers, 3d. per hr. Overtime, 1d. per hr. more.

*Carmarthen.*—Aged 18 and over, 5d. per hr. for 8 hr. per day. Overtime at 6d. per hr.

*Glamorgan.*—Aged 18 and over, 6d. per hr. for 8½ hr. per day. Overtime, 7d. per hr. on weekdays and 7½d. per hr. on Sundays.

The Board also made the following Orders for areas for which rates were already in operation:—*Gloucester*: Minimum rates of wages for carters, shepherds and stockmen under 21 years of age, together with an amended Sunday overtime rate for adults of those classes and overtime rates for all male workers under 21

*Holland*: An Order continuing the operation of the minimum rates already in force (which are due to expire on 5th April) up to 31st October, 1925, the only amendments being that the weekly minimum rates will be payable as from 5th April in respect of a week of 52 hr. instead of 48 hr. as at present, and an addition of 1s. per week to the special payments for cattlemen and shepherds. *Shropshire*: An Order cancelling the present rate for male workers for time in excess of 54 hr. and under 57 hr. and fixing overtime rates for all time in excess of 54 hr.; the overtime rates for male workers aged 21 and over being 8d. per hr. for employment in excess of 54 hr. and under 60 hr., and 9d. per hr. for employment in excess of 60 hr., and for all employment on Sundays.

Copies of the Orders in full can be obtained on application to the Secretary of the Agricultural Wages Board.

The next meeting of the Board will be held on Wednesday, 25th March, 1925.

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THE Ministry desires to point out to farmers within a working radius of the existing beet-sugar factories, and of those in course

### **Sugar-Beet Industry.**

of erection, that these factories require a further contracted acreage in order that, with the assistance of the subsidy now to be granted on sugar produced, they can make an effective start in establishing the sugar-beet industry in this country on a broad and stable basis and justify the large expenditure of capital to which the manufacturers stand committed.

The subsidy scheme has been designed in the belief that the beet-sugar industry will prove of great national value, but the success of the scheme necessarily depends on the support of the farming community. The Ministry feels, therefore, that having regard to the fact that the prices offered to the farmers for their beets have received the approval of the National Farmers' Union and are likely to ensure a reasonable return on the costs of production, every farmer should give serious consideration to the introduction of sugar-beet cultivation into his farming programme.

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## **AGRICULTURE ABROAD.**

THE first session of the American Institute of Co-operation, the formation of which was referred to in this *Journal* for

### **American Institute of Co-operation.**

November last, p. 703, has been announced to take place at the University of Pennsylvania, Philadelphia, from 20th July, to 15th August, 1925.

The object of the Institute is to provide a source from which members, employees and officers of co-operative marketing



organisations, teachers of marketing in universities and colleges, public marketing officials and private and public research workers will be able to secure training. Practical experience and knowledge will be pooled for mutual benefit and the advancement of sound co-operation.

The staff of the Institute will include picked men from a wide range of co-operative organisations and from the leading educational institutions. In addition, several authorities of international reputation will attend from Europe.

The topics for study at the first session have been settled as follows:—

*First Week: Economic Principles and Legal Structures of Co-operation.*

History of Co-operation.	Possibilities and Limitations.
Ideals of the Movement.	Status of State and Federal Legislation.
Development of Types.	Education in Co-operation.

*Second Week: Organisation and Membership Problems.*

Preliminary Market Surveys.	Patronage Costs.
Forms of Organisation.	Educational Work with Members.
Organisation Finance.	The Co-operative and the Community.

*Third Week: Operating Methods and Management Problems.*

Source of Personnel.	Warehousing.
Business Practices.	Grading and Standardisation.
Auditing and Accounting.	Methods of Pooling.
Marketing Finance.	

*Fourth Week: Sales Policies and Price Problems.*

What is Meant by Orderly Marketing?  
 Selling Plans for Principal Commodities.  
 The Development of Markets.  
 Price Objectives of Co-operatives.  
 Selling Problems.  
 Credits and Collections.  
 Effect of To-day's Price on To-morrow's Production.

The project is said to have the backing of organisations representing over two million American farmers and to be officially recognised by State Departments of Agriculture, State Bureaux of Markets, and the Federal Department of Agriculture at Washington.

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THE Waite Agricultural Research Institute has been established by the University of Adelaide for the purpose of

**New Australian Agricultural Research Institute.** conducting investigational and research work in agriculture. The establishment of the Institute was rendered possible by the magnificent gift of the late Mr. Peter Waite, a sheep farmer of South Australia who bequeathed £100,000 to the University of Adelaide for agricultural

research. The Government of South Australia has supplemented the bequest by an appropriation equal to the annual value of the endowment, namely, £5,000 per annum. The Institute is located at Glen Osmond,  $3\frac{1}{2}$  miles from Adelaide on an area of 300 acres of good agricultural land. With the funds available it is proposed to conduct investigational work in agronomy, agricultural chemistry, plant pathology and plant genetics.

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IN the "Experiment Station Record" for July, 1924, appeared an account of the funds provided by Congress for the

**Expenditure  
of the U.S.A.  
Department of  
Agriculture,  
1924-5.**

use of the Department of Agriculture during the year ending 30th June, 1925. The total sum provided for agriculture was \$51,936,000 (at \$4.60 to the £, approximately £11,290,000) compared with \$55,447,000 for 1923-24. A number of further items of expenditure, however, were approved by both Houses of Congress, but the Bills failed to pass before the close of the Session. These included \$3,500,000 (£760,000) for foot-and-mouth disease. It is stated that taking all these factors into account the ultimate total provision for the work of the Department seems certain to be somewhat in excess of that of any previous fiscal year.

The main divisions of the Department's work and the funds provided for them were as follows (at \$4.60 to the £):—

	£
Office of the Secretary ... ..	1,459,000
Weather Bureau ... ..	440,000
Bureau of Animal Industry ... ..	1,636,000
Bureau of Plant Industry ... ..	802,000
Forest Service ... ..	1,735,000
Bureau of Chemistry ... ..	302,000
Bureau of Soils ... ..	85,000
Bureau of Entomology ... ..	449,000
Bureau of Agricultural Economics ... ..	940,000
Bureau of Biological Survey ... ..	194,000

The programme being carried out by the Department during the year is largely a routine one. The principal items of increase are, as a rule, in connection with the regulations enforced by it or for the enlargement of control work directed against particular pests and diseases. The commencement of comparatively few new research projects is authorised, and the Department's prevailing policies and schemes will be continued without material modification.



## NOTICES OF BOOKS.

**Crop Production in India.**—(Albert Howard, C.I.E., M.A., Oxford University Press, 10s. 6d. net.) This book deals with the problems which present themselves to farmers, and to those engaged in agricultural research in India. It has been written with the idea of enlisting the interest of the general public in these problems, and in the measures that are being taken to solve them; it has the subsidiary purpose of encouraging this work, and attracting to it a number of active and enthusiastic investigators.

It is divided into three sections, the first of which deals with the soil, the second with the crop, and the third with the organisation of research work. A good deal of emphasis is laid upon the place of agriculture in the economics of India, because, as the writer correctly says, agriculture will be the primary industry of India for many years yet to come, and it is of the utmost importance that the necessary research work should be done to enable the best results to be obtained by those engaged in the industry.

In all tropical countries the problem of primary importance to agriculture is that of dealing with the water supply, and this problem presents itself no less in India than elsewhere. By quoting a series of examples of damage resulting from the heavy rainfall during the monsoons, and the local and comparatively small adoption of systems of conservation of the water supply, the writer explains these problems. He points out that surface drainage is of the utmost importance because the "run off" erodes the fertile soil, and has in some parts destroyed the agricultural value of many thousands of acres by the creation of deep ravines extending in a network about the main channel of a river. The wealth of water is thus not only valueless, but actually harmful, and must be dealt with before the results of crop research can be of real service to the agricultural population.

Mr. Howard examines the work, which has so far been done on each crop cultivated in the peninsula, and he provides a bibliography covering each section of this work for the benefit of those readers of his book whose interest may be sufficiently aroused.

Part three of the book deals with the organisation of research work, and makes a comparison of the methods of finance and organisation in different countries, but, although he makes tentative suggestions, the writer might possibly have explored this part of the subject more fully.

**Farmers and the C.W.S.**—(Published by the Co-operative Wholesale Society, Ltd., 118, Corporation Street, Manchester.) This is an interesting booklet which aims at demonstrating the advantages of inter-trading between the agricultural and industrial co-operative movements. The latter, to quote the booklet, "with its experience, numbers and power, holds out its hand to British agriculture. It invites co-operative farmers, as essential producers and consumers themselves, to share in the commerce and in the mind and spirit of British co-operation."

**Practical Buttermaking.**—C. W. Walker-Tisdale, F.C.S., and Theodore R. Robinson, F.S.I. London: The Swarthmore Press, Ltd., price 3s. 6d. net.) This book is usually regarded as one of the standard works on buttermaking, as carried out on the farm. Formerly it contained a section devoted to "Buttermaking at the Creamery,"

as mentioned on page 111, and it is to be regretted that this section has now been dropped.

The illustrations are excellent, the book is well arranged and altogether should prove very useful to the student attending either a travelling dairy school or a dairy course at a farm institute, etc., and still more useful to those who cannot attend either.

**The Agricultural Situation.**—(G. F. Warren and F. A. Pearson. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1924. Price 15s.) This admirable book makes an important contribution to the study of the economic causes underlying agricultural prosperity or depression. Although it is concerned primarily with conditions in the United States, the subject is treated broadly and the general economic conditions are applicable to agriculture wherever it is practised.

The greater part of the book is concerned with the study of American agriculture during the decade following the year 1914, that is to say, during a period of acute economic disturbance in which the general level of prices was first rising rapidly and then falling still more rapidly. The price movements of all the primary products of agriculture are studied individually and illustrated diagrammatically during the inflation period, and deflation period respectively. The relation of farm prices to the prices of commodities the farmer had to buy are similarly examined, as also is the course of taxation, bankruptcies, and other economic factors reacting upon the welfare of agriculture. A valuable chapter deals with the indirect consequence to agriculture of monetary instability, and a further chapter refers to other agricultural depressions, showing how much the variations in the purchasing power of money have been responsible for the periods of depression which occurred in the earlier part of the 19th century.

The book once more provides a demonstration, admirably supported by statistical tables and diagrams, of two facts which happily are now being written about and understood much more widely than hitherto: firstly, that the agricultural depression which began in 1920 was brought about primarily by monetary causes; and secondly, that in previous periods of depression monetary causes have played an important if not predominating part. To agriculture unstable money is disastrous.

When they turn to the probable future course of prices, a subject of supreme importance to agriculture, the authors are perhaps on more debatable grounds. On this matter they are pessimistic. Their considered opinion is that the general level of prices will gradually fall owing to an inadequate supply of gold. They are apparently sceptical about the ability of the Federal Reserve Banks and the Central Banks of other countries to cope with the situation:—

“Some people believe that with the federal reserve system prices will be maintained at a high level. It may be recalled that this argument was used in 1919, and with the federal reserve system there occurred the most violent drop in prices of which we have a statistical record in America.”

But this seems to imply that the Federal Reserve Board have learned nothing since 1919. As a matter of fact they have learned a great deal, as is shown (amongst other things) by the comparative steadiness of American prices during the last three years, notwithstanding the



continued inflow of gold. The future course of prices may be uncertain, but it is reasonable to hope that joint action of the Federal Reserve Board and the Bank of England may succeed in preventing the wide variations in the commodity value of gold such as occurred in the 19th century, with their attendant harmful consequence to agriculture.

**Fruit Pollination in Relation to Commercial Fruit Growing.**—(Cecil H. Hooper, M.R.A.C., F.L.S. Fruit Bulletin 10, 1925; South-Eastern Agric. Coll., Wye, 8 pp., price 1s.) In this bulletin, which is reprinted from the "Fruit, Flower, and Vegetable Trades Review," the pollination of both bush fruit and top fruit are dealt with. The varieties of apples, pears, plums and cherries are shown as being sterile, partially fertile or self fertile, and are further classified according to their order of flowering. Mr. Hooper believes that the bumble bees, the hive bees, and the small wild bees are the most valuable as transporters of pollen. A useful bulletin giving much information in a condensed form, which should be valuable to growers, even outside the Kent area.

**A Textbook of General Botany for Colleges and Universities.**—(Richard M. Holman and Wilfred W. Robbins, 570 pp. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1924. Price £1.) In few things does the personal factor enter more strongly than in the making and in the choosing of textbooks; the present work, however, is one which will make many friends. The authors are men who hold high teaching posts in the University of California, and as an outcome of their experience have aimed at producing a work which can take the place of lecture notes and allow the teachers to devote more time to practical work, etc. There are many in this country whose sympathies are with this point of view. The book possesses two outstanding features: it is admirably illustrated and it is well supplied with summaries and contrasting paragraphs, arranged in parallel columns. Many of the illustrations are original, most of them are diagrammatic, and some are of especial interest; those which are not original possess the advantage that they are mostly new to textbooks. It is worth while drawing attention to Fig. 126, on p. 161, which is not our common Ivy (*Hedera helix*), but the common *Ampelopsis Veitchii*. There are two parts. Part I (pp. 1-316) deals with the anatomy, morphology and physiology of the Spermatophytes, using well-known agricultural, arboricultural and horticultural species as examples. Part II is mainly devoted to a short study of fungi, ferns, etc., but to these are added accounts of the life history of a gymnosperm (pine) and of a cereal (wheat), and also a chapter on evolution and heredity. While the book is designed as a class-book for the teacher who wishes to teach rather than lecture, it will also be invaluable for the student working by himself and for the student who wishes to supplement his notes. It does not include systematic botany of the higher orders—which is usually specialised for each particular branch of study—but otherwise it is eminently suitable for those taking degrees in agriculture, forestry, horticulture, medicine, etc. The authors have had a clear conception of what they consider necessary, and their arrangement will appeal very strongly to many modern teachers and students.

**Year Book of the National Farmers' Union, 1925.**  
(National Farmers' Union, London: Price 1s.) This publi-

cation consists of fourteen sections, dealing with subjects of importance to agriculturists at the present time. It should be of much value to members, and is calculated to demonstrate to all farmers who are not yet members of any farmers' association the importance, indeed necessity, of combination, if agriculture is to hold its own with opposing interests. Section I ought to be very useful: it contains, for each county, a list of agricultural educational institutions, experimental or demonstration stations, agricultural organisers, centres to which farmers may apply for advice, and the Ministry's livestock officers. A sketch is also given of the activities of these various officers and centres in assisting farmers, and of the progress of research during 1924. A section dealing with the farmer's income tax, by Mr. Chas. H. Tolley, A.C.I.S., contains all the information required by both tenant farmers and occupying owners, who naturally do not wish to pay more than they are properly liable for. Notes on tithes and land tax are also included.

The possibilities of co-operation for farmers are discussed in a section which is of particular importance, as the National Farmers' Union has undertaken on behalf of its members to carry out certain work hitherto performed by the Agricultural Organisation Society, which has now come to an end. It is stated that the number of societies working on successful lines and giving satisfaction to their members is a proof that, given the right condition and efficient management, advantage can accrue from this form of combination. It is the wish of the Union when approached by any group of farmers desiring to co-operate for specific purposes to do its best to help them to render any scheme which is launched as proof against risk of failure, as it is possible to make any commercial scheme. In a section dealing with the sugar beet industry the successful efforts of the Union to secure contracts on improved terms for growers in 1923 and 1924 are described, and a similar account of the negotiation with regard to milk contracts for 1924-5 is contained in the account of the work of the Milk and Dairy Produce Committee. These afford a striking exemplification of the value to farmers of collective bargaining through the National Farmers' Union when they are dealing with organised manufacturers or distributors.

Other sections deal with Legislation affecting Agriculture in 1924, Labour, Prices and Supplies, Facts and Hints on Railway Transport, Government Departments, and other subjects, in addition to a complete account of the many-sided work of the Union during the year, and a large amount of information of a reference nature. A good index greatly increases the usefulness of the Year Book.

\* \* \* \* \*

**Importation of Plants, Bulbs, etc., from the United States of America.**--The Ministry desires to remind importers of plants, bulbs, etc., from the U.S.A., of the importance of arranging for consignments to be accompanied by official certificates of health in the form prescribed in the Destructive Insects and Pests Order of 1922. This Order requires that plants imported into England and Wales shall be accompanied by a certificate issued by a duly authorised official of the country of origin not more than 14 days prior to the date of shipment of the consignment to the effect that the plants, etc., have been inspected and found to be healthy and free from certain specified diseases and pests.



The certificates of inspection of nursery stock issued by certain State officials under the Farms and Markets Law of the United States cannot be accepted as complying with the requirements of the Destructive Insects and Pests Order, and consignments arriving in this country with such certificates only will be treated as uncertificated consignments, examination of which will be required to be made by one of the Ministry's Inspectors at the expense of the importer.

\* \* \* \* \*

**Agricultural Exhibition in Belgium.**—An international agricultural exhibition is to be held at Liège from 4th to 13th July, 1925, which is to be honoured by a visit from the King and Queen of Belgium.

In addition to sections covering horticulture, poultry keeping and bee keeping, there will be an important section devoted to agricultural education, a dog show, and an exhibition of agricultural machinery and implements.

The exhibition is to be organised by the Société Royale Agricole de l'Est de la Belgique, and 150,000 francs has been set aside for the construction of stands, etc., and 160,000 francs for prizes.

Endeavours will be made to obtain the admission of exhibits free of customs duty.

\* \* \* \* \*

**Foot-and-Mouth Disease.**—Two fresh centres of disease have occurred since the March issue of the *Journal* was published, disease being confirmed on 2nd March at Rudheath, Northwich, Cheshire, and on 14th March on premises near Yarmouth, Isle of Wight. The usual restrictions were applied to the surrounding area of 15 miles radius in the first case, and to the Isle of Wight in the other case.

There have been no developments of the disease in respect of the areas referred to in the March issue of the *Journal*, and in all cases the restricted areas have been either materially reduced or entirely released from restrictions.

\* \* \* \* \*

**Leaflets issued by the Ministry.** — Since the date of the list given on p. 887 of the December, 1924, issue of the *Journal*, the following leaflets have been issued:—

*New:*—No. 76. Wire Fencing for Grassland.

„ 91. Peppermint: Its Cultivation and Distillation.

„ 99. Loans for the Purchase of Lime.

„ 103. Young Farmers' Clubs. (Boys' and Girls' Agricultural Clubs.)

„ 104. Feeding for Winter Beef Production.

*Re-written:*—No. 164. Potato Leaf-Roll.

„ 242. Stripe Disease of Tomatoes.

*Revised:*—No. 56. Apple Canker.

„ 377. "Reversion" or "Nettlehead" of Black Currant.

„ 400. List of Publications.

*Amended:*—No. 81. A Substitute for Dishorning.

„ 105. Wart Disease.

„ 153. Storing of Mangolds and Turnips.

## ADDITIONS TO THE LIBRARY.

**Agriculture, General and Miscellaneous.**

- Brooks, F. T.* (edit.).—Report of Proceedings of the Imperial Botanical Conference held at the Imperial College of Science and Technology, South Kensington, July 7-16, 1924. (405 pp.) Cambridge: University Press, 1925, 15s. [58.]
- Morse, R., and Palmer, R.*—British Weeds: Their Identification and Control. (207 pp. + viii pl.) London: Benn, 1925, 10s. 6d. [63.259.]
- Seale-Hayne Agricultural College.*—Pamphlet 14:—Spotted Medick (a Weed of Grass Land), by *E. W. Fenton*. (8 pp.) Newton Abbot, 1925. [63.259.]
- Somerville, W.*—Use of Basic Slag. Reprint from "The Times." (7 pp.) London: British Basic Slag, Ltd., 1925, gratis. [63.1672.]
- Cole, G. D. H.*—The Life of William Cobbett, with a chapter on "Rural Rides," by *F. E. Green*. (458 pp.) London: Collins, 1925, 18s. [92.]

**Field Crops.**

- University of Leeds and the Yorkshire Council for Agricultural Education.*—Report No. 137:—Results of Experiments with Cereals, Peas, Potatoes, Swedes, Turnips and Mangels in Yorkshire, 1924. (13 pp.) Leeds, 1925. [63.3.]
- Canada Department of Agriculture.*—Bull. 42 (New Series):—Experiments with Wheat at the Dominion Experimental Farm, Brandon, Manitoba. A Summary, 1889-1923. (54 pp.) Ottawa, 1924. [63.311.]
- Fisher, R. A.*—The Influence of Rainfall on the Yield of Wheat at Rothamsted. Philosophical Transactions of the Royal Society of London, Series B, vol. 213, pp. 89-142. London: Harrison & Sons, 1924, 5s. [63.311; 551.5.]
- Minnesota Agricultural Experiment Station.*—Bull. 206:—Wheat and Flax as Combination Crops. (12 pp.) St. Paul, 1924. [63.311; 63.34111.]
- Minnesota Agricultural Experiment Station.*—Bull. 212:—Potato Investigations at the North Central Experiment Station, 1914-1923. (58 pp.) St. Paul, 1924. [63.512.]

**Horticulture and Fruit Growing.**

- U.S. Department of Agriculture.*—Farmers' Bull. 1431:—Greenhouse Tomatoes. (24 pp.) Washington, 1924. [63.513.]
- Morton, J. W.*—Profitable Bush Fruit Culture. (63 pp.) London: Ernest Benn, 1925, 2s. 6d. [63.41(c).]
- Morton, J. W.*—Practical Pruning for all Growers of Fruit. (137 pp.) London: Lockwood Press, 1925, 2s. 6d. [63.41-195.]

**Plant Diseases.**

- Bunting, R. H., and Dade, H. A.*—Gold Coast Plant Diseases. (124 pp. + xxi pl.) London: Crown Agents for the Colonies, 1924, 6s. [63.24-34.]
- U.S. Department of Agriculture.*—Dept. Bull. 1299:—Relative Resistance of Wheat to Bunt (*Tilletia tritici*) in the Pacific Coast States. (29 pp.) Washington, 1925. [63.24.]
- Pennsylvania Department of Agriculture.*—General Bull. 394:—Potato Wart (*Synchytrium endobioticum*). (28 pp.) Harrisburg, 1924. [63.24.]
- Missouri Agricultural Experiment Station.*—Bull. 216:—Spraying Missouri Fruits. (32 pp.) Columbia, 1924. [63.294.]

**Live Stock.**

- Midland Agricultural and Dairy College.*—Report on the Use of Palm Kernel By-Products in the Fattening of Pigs and their Influence on Pork and Bacon. (12 pp.) Sutton Bonington, 1925. [63.64: 043.]
- Illinois Agricultural Experiment Station.*—Bull. 247:—Feeding Pigs on Pasture. (25 pp.) Urbana, 1924. [63.64: 043.]
- South Dakota Agricultural Experiment Station.*—Bull. 209:—Potatoes as a Feed for Fattening Pigs. (20 pp.) Brookings, 1924.



# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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## NOTES FOR THE MONTH.

THE first of a series of reports on economic subjects connected with agriculture, which the Ministry has in preparation, has

**Co-operative  
Marketing of  
Agricultural  
Produce.\***

just been issued. A feature of the series will be reports based on the detailed investigations now being undertaken by the Department into commodity marketing and kindred problems. It is fitting, therefore, that the first report should be a survey of the present stage of development of the co-operative marketing movement in this country, for, as stated in the report, "there is a striking dearth of that responsible and comprehensive information which is necessary to enable the present position of the movement to be appreciated and understood and to serve as a basis for future effort and enterprise."

The report contains a mass of information derived from a careful and critical analysis of the returns and balance sheets of the societies themselves and from reports furnished by the Ministry's officers. All the usual forms of co-operative marketing activity, including livestock auction marts, slaughter-houses, bacon factories, the sale and processing of milk and dairy produce and the marketing of eggs, poultry, fruit, vegetables and wool are separately reviewed. The methods and results of a number of societies are described in detail by way of illustration, and the whole is adjusted as to perspective by an interesting historical background showing the development of the various forms of co-operative marketing in this country from the early days and the general trend of events which have affected the course of the movement as a whole during the past fifty years.

No such exhaustive survey of co-operative marketing has previously been attempted so far as this country is concerned.

\* Report on Co-operative Marketing of Agricultural Produce in England and Wales (Economic Series No. 1), obtainable from His Majesty's Stationery Office, price 1s. 6d. (1s. 8½d. post free).

Indeed, even the flood of literature relating to agricultural co-operation which is poured out in ever-increasing volume by other countries, contains nothing more intensive and informative regarding existing practice than the report just issued. It should prove of enduring value to all interested in the economic organisation of agriculture in this country, and though the progress and results which it records are, in a sense, disappointing, it may not be without interest also in those parts of the world where co-operation is the main constructive idea now being directed to the enhancement of marketing efficiency.

An important chapter of the report deals with the past efforts of societies at federation for trading purposes, and discusses the economic purpose and significance of federal action in the performance of extra-local marketing services. Another chapter of general application deals with inter-trading between the agricultural and industrial co-operative movements. A number of fundamental issues are brought together for discussion in the final chapter, and it is here that all routes converge. The importance of a careful and dispassionate analysis of the business situation before any new venture is launched, the importance of the management factor, of adequately paid management, of adequate turnover and capitalisation and the provision of reserves, of grading and standardisation, of a "safety-first" price policy, and last, but not least, the importance of membership contracts in ensuring a guaranteed supply of produce for each undertaking, are put with emphasis. The report shows conclusively that far more attention must be given to these considerations in future than has been customary in the past. Indeed, to the great majority of farmers, not excluding members of existing co-operative undertakings, co-operation is little more than a name, and it is unusual to find farmers who use their societies actively as their principal medium of business. As the report says, many farmers are, at present, merely "playing with co-operation and not committing themselves to a thorough-going experiment." It is in the light of these facts, therefore, that past failures must be viewed. It may even be held that co-operative marketing as understood and practised to-day in the Dominions and elsewhere has never been really tried out in this country. The way is, therefore, open for the future, but there appears to be no sure foundation on which to build until farmers, as a whole, more fully appreciate the purpose and significance of the principles underlying co-operative organisation and have satisfied themselves that, in the final



analysis, co-operative marketing, based on such principles, will, in fact, prove to be *better business*; only when so convinced are they likely to stand by the system in the manner and to the extent which is common in other lands, and to back it with all or an agreed proportion of the produce at their command.

\* \* \* \* \*

THROUGH the kindness of the authorities of Oxford University, of Balliol College, and of the School of Rural Economy with its Research Institutes in Agricultural Economics and Agricultural Engineering, a very representative Conference of Agricultural Organisers was held in Balliol College from 3rd to 8th April.

**Conference of  
Agricultural  
Organisers at  
Oxford.**

Part of the proceedings consisted in a joint discussion between Agricultural Organisers and Specialist Advisory Officers on their mutual relations, for which the attendance of the latter class of officers was necessary, and opportunity was taken at the same time to arrange sectional conferences of these latter officers in economics, chemistry, entomology and mycology. The various meetings were also attended by officers of the Ministry and by members of the staffs of the School of Rural Economy and the two Research Institutes, and some 150 persons in all were present during the conference. At various times the conference was attended by the Minister of Agriculture (Rt. Hon. E. F. L. Wood, M.P.), and the Parliamentary Secretary (Lord Bledisloe), Dr. L. R. Farnell (Rector of Exeter College, and Pro-Vice-Chancellor of the University), Sir Francis Floud and Sir Daniel Hall. A reception was held by the Minister on the evening of Friday, 3rd April, and a welcome was extended to the conference by the Rector of Exeter on behalf of Oxford University on Saturday, 4th April. The proceedings were formally opened by the Minister on the same day.

The principal aim of the conference was to discuss the principles of agricultural experimental work, with special reference to the question of experimental error; and papers on these subjects were read by Sir D. Hall, who dealt with the general principles of agricultural experiments; by Mr. F. L. Engledow, who explained the theory of experimental error; by Sir J. Russell, who described the technique of manurial trials; by Mr. W. H. Parker, whose subject was the technique of variety trials; and by Mr. R. G. Hatton, who spoke on the technique of fruit experiments. The meeting place afforded those present

an opportunity of familiarising themselves with the educational and research work now carried on at the University to an increasing degree; the work of the School of Rural Economy was described by Mr. C. G. T. Morison (in the absence through illness of Prof. W. Somerville), that of the Institute of Agricultural Engineering by Dr. B. J. Owen; and that of the Institute of Agricultural Economics by Mr. C. S. Orwin. Further variety was introduced into the proceedings of the conference by Prof. T. B. Wood, who dealt with recent work carried out by the Animal Nutrition Institute, Cambridge University, on the nutrition of the pig; by Mr. G. D. Amery, whose subject was early agricultural literature; and by Dr. J. A. Hanley, who addressed the conference on grassland improvement. Excursions were arranged having both an agricultural and an everyday interest, the former including visits to the Kelmscott herd of dairy shorthorns and the University Farm—where the work of the Agricultural Engineering Institute was illustrated; and the latter, visits to the Morris works and the University Press, as well as to different colleges.

In opening the conference the Minister of Agriculture (the Rt. Hon. E. F. L. Wood, M.P.), referred to the distinguished men such as Lord Ernle, Sir Daniel Hall, Mr. F. D. Acland—whom Balliol College had contributed to the agricultural world. He pointed to the increasing importance of Oxford University as a centre of agricultural education and research, possessing as it did, not only the teaching centre at the School of Rural Economy, presided over by Professor W. Somerville, but also the Research Institute in Agricultural Economics, directed by Mr. C. S. Orwin, and that in the Agricultural Engineering, directed by Dr. B. J. Owen. He thought it was true to say that the economics of agriculture which had hitherto been the Cinderella of agricultural investigation were at last attaining to their rightful place in research, advisory and educational schemes. He hoped the conference would become a periodic event and an integral part of the organisation of educational and advisory work. Research, advisory and educational work in agriculture was very fortunate in one respect—it enjoyed the support of all political parties. It was noticeable that whenever agriculture had been subject to review—as had very frequently been the case in recent times—the importance of education and research had always formed one of the principal recommendations made. That was a great source of strength.



It was sometimes asked why the Ministry did not make County Authorities move more quickly in agricultural education. Those who put this question forgot that while the Ministry had a great share in the organisation by providing the sinews of finance, the work depended for its success on an effective spirit of partnership between the Ministry and the County Councils; and if the principle of local autonomy were superseded the ultimate interests of agricultural education would not be promoted.

It was, further, not always realised how very new the research and educational system was. It was really only a six years' old child, since although the outlines of the system and, in some cases, rather more than outlines, existed previous to 1914, nevertheless organisation as we now see it was in the main the work of the post-war period. In the last completed year previous to the war, the total amount spent by the Ministry on the maintenance of agricultural research was £32,000: this had now risen to £260,000, and the total expenditure by the State on agricultural education and research in the present financial year was estimated at approximately £650,000. This figure was not quoted on the theory that efficiency and improvement were synonymous with expenditure; on the other hand, it could not always be compared favourably with the expenditure of other countries in this direction. But it did show that since the war the Government had given much assistance to the development of agricultural education and research; and considerable progress had been made.

The whole of this system rested on the county agricultural organiser as the foundation. He had first of all the function of teaching the sons and daughters of agriculturists, and next, what was perhaps more difficult, that of advising and educating the adult farmers on methods of improving their farming practice. He (the Minister) had always felt that there was something of a gap between the research and scientific work that was going on and the ordinary working farmer. In considering methods of bridging this gap, he thought that not much could be learnt by reading; more could be learnt by hearing; and nearly everybody could learn by seeing. The practice of sending the farmer leaflets and literature was good in its way, but was not so effective as arranging lectures or discussion societies; and the best practice was that of demonstrations. He was quite sure that much would be achieved by this last method.

The Minister concluded by expressing the hope that as a result of the bringing together in such conferences of a great variety of thought, ideas and experience, agricultural organisers, advisory officers, research workers and others would be led to feel that they were partners working together in a common business to which all would be enabled to make a contribution of increasing value.

The conference was an undoubted success; among the many results it is only possible to refer here to two. In the first place it was made abundantly clear that yield figures obtained from trials in which no provision was made for adequate replication of plots could not be expected to give a fully reliable measure of the value of any given treatment, owing to the extent of the experimental error involved; that such trials were nevertheless of value for demonstrational purposes when the known value of the treatment was so great as to be many times larger than the experimental error, or when the object of the work was to bring out points other than yield—*e.g.*, difference in plant characteristics; that for reliable results to be obtained from field experiments replication and “careful randomisation” of plots is necessary; and that results cannot be regarded as significant unless the differences in yield of plots under treatment from control plots are at least three times the probable error.

In the second place the value of the conference in bringing together the general practitioners of agriculture—the agricultural organisers—and the specialists—the advisory officers, was amply demonstrated. Each class of officer was assisted to realise the kind of problem to be solved, and work to be carried out, by the other class of officer; to realise also the fact that for the complete success of the scheme of advisory work among farmers the closest and most cordial relations between the two classes of officers are necessary. The conference seemed to show that there was every ground for believing that in almost all cases friendly relations have already been established, which cannot but be cemented by meetings of this character.

\* \* \* \* \*

The Ministry has now prepared a draft Order under the Land Drainage Acts, which, if confirmed, will provide for the temporary suspension of most of the rating in what are known as the upland areas of the Ouse Drainage District. It will not, however, provide for the exemption of these areas from rates

**Ouse Drainage  
Rates.**



made before the Order comes into force. The Order also makes special provision as to the carrying out of works in the upland areas during the suspensory period.

A copy of the Order can be obtained free of charge on application to the Ministry's Office at 10, Whitehall Place, London, S.W.1.

\* \* \* \* \*

THE Minister of Agriculture and Fisheries (the Rt. Hon. Edward Wood, M.P.), early in April appointed:—Sir H. C.

**Ouse Drainage  
Commission.**

Monro, K.C.B. (*Chairman*) (late Permanent Secretary to the Local Government Board), Sir John Oakley (past President of the Surveyors' Institute), Mr. W. J. E. Binnie (M.A., M.Inst.C.E., F.G.S.), and Mr. Leopold Harvey (Solicitor, Clerk to the Welland Drainage Board and other Drainage Authorities), as Commissioners to investigate the whole problem of the drainage connected with the River Ouse, with a view to advising the Ministry on the following points:—

- (i) The nature and extent of the essential works required to put the Ouse Drainage System in a proper state and the estimated cost thereof.
- (ii) The degree of benefit likely to be conferred on the various areas and sub-areas, into which the Ouse Drainage District is at present divided, by the execution of such works as are reported by the Commissioners to be so required.
- (iii) The ability of the several areas and sub-areas respectively to contribute to the cost of executing such works.
- (iv) The amount of Government financial assistance which would be essential to secure the execution of such works.
- (v) The amendments of the Ouse Drainage Order necessary or expedient for enabling the Ouse Drainage District to be drained effectually.

The Minister had also appointed Mr. H. Meadows, of the Ministry, 10, Whitehall Place, London, S.W.1, to be Secretary to the Commissioners, and all communications should be addressed to him.

\* \* \* \* \*

THE British Empire Exhibition is to be opened by His Majesty the King on 9th May, and the hope may be expressed

**Agricultural  
Research Exhibit  
at Wembley.**

that the Exhibition will prove a great success, both financially and as illustrating in some measure what the British Empire is and does. There will be much to be seen at the Exhibition which is of interest and importance to the general public, and certainly no visitor should miss seeing the British Government Pavilion, with its displays relative to agriculture, science, trade, health, housing, transport, the army, the navy, the air service and other items.

From the farmers' point of view the most attractive corner ought certainly to be the gallery of the Ministry of Agriculture, in which will be shown a representative collection of exhibits illustrating the problems dealt with by the independent agricultural research stations now financed chiefly by Government funds. The exhibits must be regarded primarily as research exhibits, but education is represented by means of a map showing the organisation of the country's agricultural institutions.

The exhibits cover a selection of subjects which attempt to outline, very briefly it is true, the story of research work which is being conducted at research institutions in England, Scotland and Wales. In order to make the exhibits even more intelligible and useful, a guide has been prepared in which an endeavour has been made to explain some of the main problems of farming, as these are represented by the soil and its treatment, farm and garden crops, live stock, land drainage, machinery, farm pests, and so forth.

The creation of the Development Fund in 1909 enabled the Departments concerned to frame a general policy of agricultural research, map out the work to be done and allot it to specially equipped institutions. With the funds which have since become available, it would be true to say that, although there is still a wide field for labour and for private munificence, there are now few agricultural problems likely to yield to research upon which some work is not being done.

In the selection, preparation and staging of the exhibits, the Research Institutions have undertaken the lion's share of the work, and to them are due, for this and for many other services, the thanks of the Ministry and of all who are interested in British agriculture. Full acknowledgment to each institution concerned is made in the official guide to the Agricultural Exhibit of the Government Pavilion, copies of which may be obtained, price 3d., post free, from the Ministry, 10, Whitehall Place, London, S.W.1.

\* \* \* \* \*

A MEETING of the Agricultural Wages Board was held on 25th March, at Gwydyr House Annexe, Whitehall, S.W.1, the

**Farm Workers' Chairman, Lord Kenyon, presiding.**  
**Minimum Wages.** The Board considered notifications from various Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages, and



proceeded to make the following Orders carrying out the Committees' decisions:—

*Beds. and Hunts.*—From 30 March (when the previous Order expired) to 31 Oct., male workers, 21 and over, 30s. 6d. for 50 hr., instead of 29s. for 48 hr. as at present. Female workers, 18 and over, increase from 5d. to 6d. per hr. Proportionate rates for younger workers and differential overtime rates, the latter in the case of adult male workers being 9d. per hr. weekdays and 11d. per hr. Sundays.

*Essex.*—Continuing the rates for male and female workers previously in force (which expired on 28 March) to 31 Oct. Male workers, 21 and over, 30s. for 50 hr. in summer (second Monday in Feb. to second Sunday in Nov.) and 48 hr. in winter (remainder of the year).

*Hereford.*—From 30 March to 30 April. Female workers, 18 and over, 4½d. per hr.; 15 and under 18, 3½d. per hr.

*Norfolk.*—From 30 March amending the existing Order so as to provide that the extra sum payable to workers under 18 employed as cowmen, bullock-tenders, and sheep-tenders and not in sole charge of animals be reduced to 3s. per wk., and that the clause guaranteeing payment for a week of 50 hr. in summer and 48 hr. in winter be restricted to workers employed by the week or longer period.

*Sussex.*—Overtime rates for all classes. Male workers, 21 and over, 9d. per hr. on weekdays and 10½d. per hr. on Sundays; female workers, 18 and over, 6½d. per hr. on weekdays and 7½d. per hr. on Sundays; lesser rates for younger workers of both sexes. The rates to operate as soon as practicable after the Sussex Agricultural Wages Committee have defined the employment to be treated as overtime employment.

*Radnor and Brecon.*—From 3 April (when existing rates expire) to 2 May (pending the fixation of rates for a longer period). Male workers, 21 and over, 31s. for 52 hr. in summer (1 Feb. to 31 Oct.) and 50 hr. in winter (rest of the year).

Copies of the Orders in full can be obtained on application to the Secretary of the Agricultural Wages Board.

\* \* \* \* \*

THE Ministry is prepared to receive, not later than 15th May, applications for grants in aid of scientific investigations bearing

**Grants for  
Agricultural  
Research.**

on agriculture to be carried out in England and Wales during the academic year commencing 1st October, 1925. The conditions on which these grants are offered are set out

on the prescribed form of application (A.53/TG), of which copies may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1.

## THE RELATIVE PALATABILITY OF PASTURE PLANTS.

WILLIAM DAVIES, B.Sc.,

*Welsh Plant Breeding Station, Aberystwyth.*

IN view of the fact that the chief grasses and clovers are grown at the Welsh Plant Breeding Station both in mixtures and in pure plots, and that the plots are grazed by sheep kept under careful control, an excellent opportunity has been afforded for studying the seasonal palatability of herbage plants. The results recorded in the present article cover observations made during the whole of 1924 and during the first three months of 1925, and apply only to the preferences shown by sheep.\* Arrangements are being made, however, to lay out plots at the College Farm (Nantcellan) in order to extend the scope of the enquiry to cover both cattle and horses.

The chief aims of the investigation have been to obtain exact information on the following points:—

- (1) Whether selective grazing does in fact take place.
- (2) Whether preference is due to some innate specific characteristic of the plants preferred, or whether selection is definitely seasonal—the plants being rather chosen for the succulency of their growth at any particular time than for any other apparent reason.

- (3) Whether all the above-ground parts of plants are equally palatable or whether some parts are relished more than others.

**Methods Adopted.**—Fairly exact quantitative data were obtained on one experiment in particular (E.37) which consisted of pure plots, 1/400th acre each, of various nationalities of the chief grasses and clovers. Sheep were given access to the whole series of plots (duplicated for each strain) for a spell of days together at regular intervals of from ten to twenty days according to the amount of growth made, which was of course dependent on the time of year. Very careful observations were made both during and immediately after each grazing period, and marks (on a scale 0-10) were allocated to each species having regard to both the initial preference of the sheep and the extent to which they grazed particular plots throughout each period. Quantitative data were also obtained on a similar plan in the case of other pure plot experiments. In addition, accurate notes were made from time to time on three separate seed mixture trials, and on a number of trials designed to test winter and early spring productivity of various species, while in general

\* For the most part Kerry Hill and Suffolk ewes and their lambs, Welsh Mountain sheep having also been grazed on some of the plots.



palatability notes have been taken after the sheep on all the enclosures and fields to which they have had access.

**Discussion of Results.**—The quantitative data obtained from the pure plots (chiefly E.37) are set out in detail in the table on p. 116. These data show that the sheep have exercised considerable selection, particularly during the summer grazing period, and also that in so far as individual species are concerned selection may be either—

(1) In favour of a particular species throughout the season, *e.g.*, red clover.

(2) In favour of a particular species only at certain growth periods of that species, *e.g.*, crested dog's tail.

Before discussing a number of interesting points that have emerged with reference to the whole question of palatability, it will be convenient to deal with the species separately, having regard to the evidence from all the trials under observation.

*The Clovers.*—It will be obvious from the results given in the Table that the clovers when regularly grazed are much sought after throughout the whole year, and that simple mixtures containing both clovers and grasses have a higher relative palatability than have the individual grasses contributing to such mixtures when grown on pure plots. There is, in fact, evidence for thinking that the grasses in a clover mixture are grazed with less discrimination and over a longer period in such mixtures than on pure plots. Observations made on the clover plots during May indicate that the more hairy types of red clover, notably American Mammoth, do not receive the same attention as average types, while the relatively hairless Bohemian red clover was undoubtedly relished more than any other strain.\*

One reason why the clovers maintain a much more uniform palatability than the grasses is probably that under more or less constant grazing they never produce very much stemmy growth, but continue all the time to develop a relative abundance of fresh and succulent leaves,† while grasses like cocksfoot and Timothy produce a considerable amount of stem during May and June, perennial rye grass for an even longer period, and tall oat grass throughout most of the summer.

\* It will be realised that a plant's grazing value depends on its productivity as much and sometimes perhaps more than on its palatability. It is not the purpose of this article to deal with productivity, thus a species or strain is not necessarily recommended for general use because it has been noted as palatable. The relative palatability of different strains of a highly palatable species may not be as important as would appear at first sight. In the case of red clover, for instance, if only one strain is employed in a mixture a relatively unpalatable strain would be likely to be grazed as heavily as a relatively palatable one.

† It is true that under pasture conditions some strains of red clover in particular develop a relatively large number of small flower heads, but these are not associated with a great deal of stem. See Williams, R. D., in Bulletin Series H. No. 3, of the Welsh Plant Breeding Station, pp. 131-150.

In the case of a series of red clovers allowed to grow tall and stemmy, and which were just commencing to come into flower before the sheep were turned on the plots, it was noted that the sheep preferred the tops of the stems including the flowering buds to even the leaves, thus, when plants are nearing maturity even the leaves lose their attraction for sheep. It is interesting to find that under the conditions of relatively hard grazing obtaining in connection with the trials under discussion, white clover has maintained a high and uniform attraction for sheep—Cockayne in New Zealand having noted this species as of relatively low palatability.\*

Subterranean clover deserves special mention; observations made on a number of trials have shown it to be quite as palatable as red clover during the spring and summer months, while the long runners developed by this plant, especially in the young stage, are readily eaten by sheep. It differs from the other clovers in one very important respect, for as well as being highly palatable during the winter it is capable of making very decided winter growth, while observations made during January and February show that like Italian rye grass it is capable even during this period of making new growth fairly rapidly after being grazed.

*Italian Rye Grass.*—During the summer period this grass takes a lower place than would have been expected. This has, however, been partly, but by no means wholly, due to the position of the plots on the main experiment, which were slightly damper than those occupied by other species, the observations as a whole showing that the slightest tendency towards stagnation immediately reacts against palatability. Italian rye grass, however, being a very rapid growing grass produces a relatively large proportion of stem even during short periods of rest at the height of the growing season—the stem leaves are palatable enough to sheep, but the stems themselves are not readily taken when other leafy herbage is available, and this would largely account for the rather low summer palatability of this species. Italian rye grass is wonderfully green in winter and maintains a measure of leafy growth throughout the winter and early spring, during which period it is unsurpassed in palatability.

On plots which had been allowed to grow to practically the flowering stage before being grazed, Italian rye grass was decidedly more palatable than perennial rye grass, cocksfoot, and most other species, but probably because on the plots in

\* Cockayne, L. "The Relative Palatability for Sheep of the Various Pasture Grasses." New Zealand Journal of Agriculture, Volume XVIII, No. 6.



question it had not attained to quite the same degree of maturity as the other grasses.

*Perennial Rye Grass*.—Perennial rye grass, though highly palatable during the winter, is slightly less so than Italian. It maintains a fairly uniform attraction for sheep during the summer, but when allowed to approximate to maturity is largely neglected.

*Cocksfoot*.—This grass takes a high place judging by the average figures. It is evident, however, that cocksfoot is only highly palatable when kept fairly closely grazed. In the summer sheep have entirely neglected plots approaching the hay stage, while in winter plots ungrazed became badly burned and relatively unpalatable. Cocksfoot properly grazed is not only of very high productivity, but of very high palatability during May and June.

*Tall Oat Grass*.—This species has taken a somewhat higher place, on the basis of the quantitative data, than might have been expected. This has, however, been largely due to the fact that the plots were kept closely grazed, for when tall oat grass is allowed to grow well into the stemmy stage it rapidly loses its attraction for sheep, and on plots in that stage was one of the last species to receive attention.

*Timothy*.—The high and well maintained seasonal palatability of Timothy to sheep has been a matter of some surprise, but has been borne out by all the trials. Being a late grass, if allowed to grow on without hard grazing until June, it appears to be very decidedly more palatable than cocksfoot, perennial rye grass or tall oat grass left until a similar date.

*Meadow Foxtail*.—Since meadow foxtail is a predominantly leafy grass it might have been expected to have been of high average palatability, but the data show that it is not relished by sheep to an outstanding extent at any period of the year. Field notes on other trials confirm this view. It is a grass which burns badly as the season advances, and towards the late autumn and winter the notes record cases where this grass had been left untouched whilst surrounding species showed evident signs of hard grazing.

*The Fescues*.—It is of interest to note from the figures in the Table that the fescues, broad and fine leaved alike, are not relished by sheep to the same extent as other grasses under observation. This has been very pronounced in the case of tall fescue, which although a very leafy grass has coarse harsh leaves which have proved relatively unpalatable. The seasonal notes have shown the plots adjacent to tall fescue, as well as the

Timothy drills which have separated the plots, consistently closely grazed, while the tall fescue itself, although showing signs of much trampling, was only lightly cropped.\*

It will be noted that even early in the year when keep is very short, and when tall fescue relative to most other species is making good growth, its palatability is still lower than that of most species.

*The Canary Grasses* (*Phalaris nodosa* and *P. arundinacea*).—Neither of these two species appears to be relished by sheep when other herbage is available. When fodder becomes scarcer (after the end of July) the plants are, however, by no means discarded, and during August and September appear to attain to average palatability.† Later, *P. arundinacea* becomes very winter-burned and unpalatable. *P. nodosa*, although remaining fairly winter-green and moderately productive, is none the less of low palatability in January and February.

*Crested Dogtail*.—It will be noted that this species has taken a comparatively high place on average figures. It is of very considerable palatability to sheep except at the period which coincides with maximum flower production (late May and early June) when a very large number of stems are developed. The stems are not touched by sheep, and it is probably this excess of stems developed at the height of the grazing season which has been chiefly responsible for the low esteem in which crested dogtail is apparently held by numerous investigators.‡ There is little doubt, however, that crested dogtail should rank as an important pasture plant on fields open to sheep throughout the year, and particularly on relatively poor land.

*Rough Stalked Meadow Grass*.—This grass is highly relished by sheep during the winter period—although the growth is but slight, it remains very winter-green and is heavily grazed. This

\* Evidence obtained on a semi-permanent pasture in Buckinghamshire would seem to suggest that both tall and meadow fescue are less palatable to milch cows than perennial rye grass and cocksfoot, for example. A 30-acre field which had been seeded out in two portions approximately 28 years ago recently came under the writer's observation. On one portion perennial rye grass and cocksfoot were the dominant grasses, while on the other portion dominance was shown by tall and meadow fescue. During the early part of the grazing season at all events the cattle showed a decided preference for the cocksfoot-rye grass area. The cattle evidence in this case thus appears to agree in detail with the sheep data given in the Table.

† Observations made during March, 1924, on one of the experimental fields of Mr. Stanley M. Bligh, of Cilmerly, Breconshire, confirm the above early season observations as to reed canary grass (*P. arundinacea*). A small area of this grass had been sown in drills on a field laid out with an ordinary mixture. The drills had made early leafy growth but had been entirely disregarded by the sheep although keep was decidedly limited at this period.

‡ See, e.g., Johnstone-Wallace, D. B. "Experiments with seed mixtures in the North Riding of Yorkshire, 1921-23." Bul. No. 136 of the Univ. of Leeds and Yorkshire Council for Agricultural Education.



was particularly noteworthy during November on red clover plots in their third harvest year, in which rough stalked meadow grass had made a strong voluntary (indigenous) appearance. During the summer months, and especially at the time of active stem production, the grass is but little sought after, and this was particularly noteworthy during June.

*Sweet Vernal Grass*.—Observations on this grass confined to the early summer would indicate a species of very low palatability, and would further show the production of excess of flowering stems during this period. From September and onwards throughout the winter, sweet vernal grass, however, appears to be amongst the more palatable of the grasses to sheep.

*Yorkshire Fog*.—This grass was eaten by sheep to an appreciable extent all through the summer, but did not then compare favourably with the grasses like cocksfoot, Timothy or perennial rye grass. During the winter when keep was very scarce such plants as occurred as weeds on the plots were closely grazed. No pure plots were available for quantitative comparison with more orthodox species.

*Miscellaneous Plants*.—Observations were made in respect of a number of the commoner weeds of grassland, and the following notes with reference to the three most abundantly occurring weeds on the plots are of interest.

*Daisies (Bellis perennis)*.—These herbs are not eaten to any great extent when other herbage is abundant, but during the winter months daisies appear to be extraordinarily palatable and much sought after by sheep. The leaves at this time are succulent and very winter-green and appear to be quite as, or even more, palatable than most grasses. Thus, during February probably the only grass that was as attractive to sheep as the daisy was Italian rye grass.

*Rib grass (Plantago lanceolata)*.—Although eaten to some extent during the summer it was only in the winter that ribgrass compared favourably with the better grasses and clovers, but during this period it was not so heavily grazed as the daisies.

*Buttercups (Ranunculus spp.)*.—The buttercups remained practically untouched even during the winter, although the leaves appeared to be succulent and were decidedly winter-green.

**The Factors Influencing Palatability.**—The observations as a whole have clearly indicated that palatability is influenced by a great number of variable factors, and it is desirable to consider the more important of these in some little detail.

*Stage of Growth*.—Speaking generally, the stage of growth of the individual plants appears to be the dominating factor affect-

ing palatability. It is the younger and more succulent growth offering on a sward that tends to receive the first and most sustained attention of sheep. Except in regard to comparatively few species, which are at all times more or less neglected, selection in the specific sense is only exercised by sheep to a marked extent during the late spring and summer period when keep is very abundant—at least this has been so in the case of the more heavily grazed swards under critical observation. At this period a number of secondary factors influence the palatability of any given species at any particular time. The following appear to be the most important.

*The Relation of Leaf to Stem.*—In the case of the grasses the sheep show an unmistakable preference for the leaf lamina as opposed to both leaf sheath and stem proper. The actual inflorescences of certain species of grasses in their young stages have a greater attraction for sheep than the stems bearing them, and sheep have been observed to graze the inflorescences of perennial rye grass and tall oat grass with apparent relish. In the case of pasture herbs like daisies, cat's ear and ribgrass, usually only the younger leaves are eaten, while the flowering shoots are almost entirely neglected.

*Harshness to Touch.*—It is probable that the chief reason for the neglect of tall fescue and to a less extent reed canary grass is the harshness of the leaves of these species, which would be at its greatest during May and June. It is probable that cocksfoot when approaching maturity is neglected for a similar reason.

*Hairiness.*—The relation of hairiness to the palatability of different strains of red clover has been mentioned, while extremely hairy plants like the buttercups and mouse-ear chickweed are but sparsely eaten even when keep is at its lowest during the winter. It is probable that the extreme hairiness of Yorkshire fog is the chief and perhaps the only reason for its relatively low palatability during the summer.

*Habit of Growth.*—The habit of growth of the grasses varies very much; the barren leaf shoots of different strains of the same species may be prostrate, erect or of intermediate habit. The two cocksfoots afford an excellent example—the indigenous plants are prostrate, the commercial more erect. Very careful notes taken after the sheep on both plots showed the erect growing commercial plants to have been more heavily grazed than the closer and more prostrate indigenous. Thus, although an excessively prostrate habit in grasses appears to be correlated with persistency, it would seem that strains possessed of such a habit are not necessarily the most desirable of pasture



plants.\* It is noteworthy that although the leaves of daisies are highly succulent throughout the summer, the sheep do not appear to trouble to reach for the closely growing leaves of these rosette plants when an abundant grass leafage may presumably be taken with less effort. The effect of the habit of growth of a palatable plant in relation to that of other palatable plants was well seen in February in the case of a ley sown with Italian rye grass and extra late Montgomery red clover. At this period the clover was making practically no growth, and the green and succulent leaves present were covered by actively growing Italian rye grass, and it was the latter which was primarily taken by sheep until the sward was grazed excessively hard. The same type of phenomenon can be noted in respect of wild white clover in the summer on fields that are not over-stocked, or more strikingly still on fields which are considerably under-stocked. It will be noted, moreover, from the Table, that during June, July and early August the commercial mixture was more heavily grazed than the indigenous, and the observations made at the time suggest that this was primarily due to the more erect growth of the plants on the former plot, the leafage of which was, therefore, more easily accessible to the sheep.

*Intensity of Grazing.*—It will be obvious from the whole trend of the data presented in this paper that the intensity of the grazing must exercise a profound effect on the palatability of different species. Very heavy grazing even in May and June will afford less scope for selection than would lighter grazing during the same period. It is not therefore to be supposed that the various species would necessarily show the same scale of palatability as here recorded at another centre stocked on a different plan, where the whole conditions would be different, probably giving a somewhat different balance as between the growth stages of the several species at any given time. It must also be remembered that the extent to which a species will be sought for at any given time will in part be determined by the number and palatability of the other species to which the grazing animals have access.

**The Seasonal Aspect of Palatability.**—The grazing year, in so far as grass-sheep are concerned, may be divided into three main periods, namely:—early period (January-April); middle period (May-September); and late period (October-December).

*Early Period* —This is the most important and difficult period of the year for the sheep breeder. Selection is shown by sheep

\* The leafage of a prostrate strain of a grass growing in a mixture with erect plants tends, however, to be drawn up by the other herbage. In connection with grass breeding the relation of prostrate to erect strains with reference to both persistency and palatability affords at once an interesting and difficult problem.

at this period for those plants that remain winter-green, *e.g.*, Italian rye grass, perennial rye grass, rough stalked meadow grass and crested dogtail, and also later in the period for species which start growth earliest in the spring, *e.g.*, Italian rye grass and tall oat grass, thus emphasising the importance of the factor of succulency.

*Middle Period.*—This period covers the time of most abundant keep on pastures; and may be divided into three sub-periods:—Pre-flowering, flowering and post-flowering.

1. (Pre-flowering.)—The constituents of a pasture are in full flush of succulent growth at this time, and selective grazing is very keen. Some of the species of earlier growth, like tall oat grass, will have begun to produce fibrous stem shoots and will tend to be relatively neglected, while very late species like Timothy will not have started vigorous growth and will not be receiving full attention.

2. (Flowering.)—This period marks the time when stock will exercise the maximum of selection—the chief tendency, however, being to leave untouched fibrous, over-mature and stemmy elements. Trials conducted at the Station indicate that in the case of pastures grazed wholly by sheep it is a sound practice to run the mower over the fields at this period—this eliminates the stems and causes a flush of fresh and succulent growth.

3. (Post-flowering.)—The growth at this period is generally predominantly leafy, and the selection of species during grazing is less intensive than during the pre-flowering or flowering periods.

*Late Period.*—During October and early November plants with a good aftermath assume considerable importance, and thus Italian rye grass and tall oat grass are usually highly palatable at this period. As November advances, species that tend to burn badly, such as meadow foxtail and cocksfoot, become unpalatable and tend to be neglected.

It should be stated that pastures fairly well grazed during September and October burn less than those which are rested, and there can be little doubt that the practice of accumulating foggage for the winter is necessarily associated with a considerable amount of waste.

Plants in their seeding year cater admirably for this period, being fresh and succulent, but too heavy grazing of young leys during the first autumn and winter is, of course, not to be recommended. It is better to make special sowings of Italian rye grass, which will also afford valuable grazing during the early period.



**The Relation of Palatability to Nutritive Value.**—In a broad way sheep appear to be decidedly discriminating with reference to choosing nutritious herbage, in so much as they exhibit a decided partiality for the highly nutritious clovers, and in the case of grasses they show a preference for young and succulent root leaves, which, as Fagan and Jones have shown, are presumably more nutritious than older leaves or stem. It is, however, quite probable that this selection in favour of a nourishing ration is largely accidental and wholly a matter of palatability, for it has been shown that they tend to neglect meadow foxtail, a grass which appears to be of particularly high feeding value, while they exhibit an unmistakable liking for Timothy, which is by no means one of the most nutritious of grasses.\*

**Summary and Conclusions.**—1. Certain species of pasture plants of generally accepted value, notably the clovers, are undoubtedly particularly palatable to sheep more or less independent of conditions or of season; while a few species, as for example tall fescue, appear always to be relatively unpalatable.

2. The chief factors influencing palatability would seem, however, to be the relative succulency of the herbage afforded by any particular species at any particular time, and this is largely due to the stage of growth of the plants.

3. The leaf lamina, particularly of young developing leaf shoots, is far more attractive to sheep than either leaf sheath or stem proper. In the case of some grasses, *e.g.*, crested dogstail, the stems are always neglected, while in the case of others the actual inflorescences are preferred to the stems.

4. The degree of harshness or of hairiness of the leaves, and the habit of growth of the plants, are secondary factors influencing palatability.

5. When the herbage consists of a number of species of about equal palatability, it will be those species the leafage of which is most easily accessible to the sheep, that is to say, which make the more erect growth, which will be chiefly grazed.

6. There are three main grazing periods during the year. The extent to which different species winter-burn has a marked effect on their palatability during the winter and early spring. During the height of the growing season plants left long ungrazed soon become mature and unpalatable.

7. Sheep will be selective in their grazing in direct proportion to the amount of palatable herbage available. The herbage is both most abundant and most varied in the early summer, when very considerable selection is exercised.

\* See Fagan, T. W., and Jones, Trevor H., "The nutritive value of grasses as shown by their chemical composition" Welsh Plant Breeding Station Bulletin, series H. No 3, p. 85.

The relative palatability of some grasses and clovers at various periods of the year, and the relative palatability for the year as a whole, are shown in the following table:—

(Marks given on a scale 0—10. 10=most palatable at time of observation.)

Species	1924						1925		Relative Palatability (Clovers 100)
	May 13th	June 1st	July 11th	August 5th 26th		Sept. 19th	Jan. 19th	Feb. 17th	
Red clover ...	10	10	10	10	10	10	10	10	100
Alsike clover ...	10	10	10	10	10	10	10	10	100
White clover ...	10	10	10	10	10	10	10	10	100
"Hay" mixture (commercial)* ...	10	10	10	10	10	10	10	10	100
"Pasture" mixture (indigenous)† ...	10	8	9	9	10	10	10	10	95
Timothy (indigenous) ...	8	5	10	10	8	8	10	9	88
Timothy (commercial) ...	10	9	8	9½	8	9	10	9	
Cocksfoot (indigenous) ...	9	8	6	8	8	9	10	9	87½
Cocksfoot (commercial) ...	10	8	7	10	9	10	10	9	
Perennial rye grass (indigenous) ...	10	5	8	10	8	9	10	9	86
Perennial rye grass (commercial) ...	10	4	8	10	8	9	10	9	
Tall oat grass (indigenous) ...	7	5	7	9	10	9	10	9	84
Tall oat grass (commercial) ...	9	5	6	9½	10	10	10	9	
Crested dogstail ...	8	2	6	9	9	10	10	9	79
Italian rye grass ...	6	8	5	5	8	7	10	10	74
Sweet vernal grass	5	3	5	8	8	10	10	9	73
Rough stalked meadow grass ...	5	2	4	6	5	7	10	9½	61
Meadow fescue ...	4	1½	3	9	3	9	10	9	61
Meadow foxtail (indigenous) ...	6	5	4	5	4	6	7	9	57½
Meadow foxtail (commercial) ...	5	5	5	7	3	6	7	8	
<i>Phalaris nodosa</i> ...	1	1	2	7	8	8	4	6	41
<i>Phalaris arundinacea</i> ...	2	½	2	6	8	6	4	—†	
Red fescue (Chewings) ...	4	2	3	4	1	2	4	8	35
Tall fescue (indigenous) ...	½	1	0	2	3	2	7	7	30
Tall fescue (commercial) ...	½	0	0	3	3	3	8	8	

\* "Hay" mixture (commercial)

	lb. per acre
Italian rye grass	2
Perennial rye grass	6
Cocksfoot	8
Timothy	4
English late flowering red clover	4
Alsike clover	1½
Wild white clover	½
Total	26

† "Pasture" mixture (indigenous)

	lb. per acre
Perennial rye grass	8
Crested dogstail	6
Rough stalked meadow grass	2
Montgomery red clover	4
Wild white clover	2
Total	26

† Dry stems only, on green foliage.



## GRASS LAND IMPROVEMENT IN THE WEST RIDING.

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DURING the last few years attention has repeatedly been called to the need for lime in many parts of England; but the question of cost has always been recognised as a serious factor, and has undoubtedly prevented the extensive liming of, at any rate, poor hill land. In this article it is hoped to show that, in certain large tracts of the West Riding of Yorkshire, liming is an economic proposition, and that—particularly now that special facilities are offered by the Government to encourage co-operative liming—it might with great advantage become a more common operation in the district under consideration, and no doubt also in other parts of the country where similar conditions prevail.

The district to which the present remarks refer is a tract of some 1,100 square miles, with Skipton-in-Craven as its approximate centre. It is a hilly area, consisting mainly of rough pasture and moorland, intersected by the fertile valleys of the upper reaches of the Nidd, Wharfe, Aire and Ribble. Although in Skipton the average annual rainfall is 38 in., on much of the surrounding higher land it is considerably heavier.

**Types of Pasture.**—The two main types of geological formation are Millstone Grit and Mountain Limestone, the former lying mainly to the south-east, and the latter to the north-west. Between the tops of the hills—which on the Millstone Grit are covered with heather, and on the Limestone formation mainly with a thin and wiry carpet of fine fescues—and the rich valley soils, there lie extensive areas of unproductive rough pasture in which the first and most serious limiting factor is undoubtedly want of lime. These pastures fall naturally into two types, according to the predominant constituent of the herbage. The first is known in the district as “White Bent Land,” and grows from 30 per cent. to 50 per cent. of mat grass or white bent (*Nardus stricta*), together with an admixture of sheep’s fescue (*Festuca ovina*), heath bedstraw (*Galium saxatile*), field woodrush (*Luzula campestris*), and tormentil (*Potentilla tormentilla*). In the second type the dominant constituent of

the herbage is common bent (*Agrostis*, spp.), and this may conveniently be termed "*Agrostis* pasture."\* With both types is associated a continuous fibrous mat of undecayed vegetable matter, which may vary in thickness from 1 in. to 3 in., and which is practically impermeable to all but the heaviest rainfall.

Botanical analyses\* were made of typical examples of the improvement of such land by lime and, in two cases, by lime and slag. A summary of certain of the results obtained is given in Tables I and II. It should be understood that the botanical analyses and rental values for each case refer to different parts of the same field; the first being that of the original untreated portion, and the others the limed, or limed and slagged areas, as indicated under "Treatment."

It should be stated that the rental values, where these could be ascertained, were in some cases actual, and in others estimated either by the tenants or the owners.

**Lime Requirement.**—In regard to the amelioration of white bent land, draining, in some cases, must be the initial step; but it is very doubtful whether this would be an economic proposition at the present time. Of such white bent land as is dry, it may be briefly said that the application of lime is the usual mode of improvement; and it is a common belief in the district that basic slag applied to such land without a previous dressing of lime fails to evoke any response. This opinion was supported by several cases examined, where it was impossible to detect, either by the eye or by botanical analyses, any result from dressings of slag alone. In forming an estimate of the amount of lime required by the type of land under consideration, the quantity of fescue present is to some extent a guide. As the percentage of fescue in the herbage increases, that of white bent decreases; and in general it is found that less lime is required on land growing a considerable amount of fescue than on pastures where this grass is less conspicuous and white bent is more decidedly dominant. As a rule white bent land has a lime-requirement of not less than 40 cwt. of quicklime per acre, and in many cases this figure is far exceeded.

**Suitable Dressings of Lime.**—In former days, when good small lime was obtainable for 3s. or 4s. per ton, it was not unusual to apply as much as 10 tons per acre, and 8 tons was

\* For fuller details see "Observations on the Improvement of Poor Pastures in the West Riding of Yorkshire," by J. C. and D. A. Lynn: *Annals of Applied Biology*, July, 1924.



a customary dose. With the disuse of farm kilns, and the rise in price, such heavy dressings are not likely to be used again, nor are they necessary. In this connection, however, it is interesting to note that lime has recently been produced on a Yorkshire farm at a cost of little more than 10s. per ton;\* and there is no doubt that many of the farm kilns that have long been closed might with advantage again be worked. On average land growing 30-40 per cent. of white bent, 15-20 per cent. of fescue, and a conspicuous amount of heath bedstraw, field woodrush, and tormentil, 3 tons per acre of good lump lime may be regarded as an adequate dressing, if followed up when the roughness begins to break—which may be from two to four years later—with 10 cwt. of basic slag. By this method better results are obtained, and at less expense, than by applying a greater quantity of lime alone. In cases where small lime is used, 4, 5, or 6 tons per acre may be the necessary dressing equivalent to 3 tons of good lump lime, according to sample. That small lime varies considerably in composition may be gathered from the following analyses†:—

				<i>Mountain Limestone.</i>		
Oxide of Lime	...	...	88.51	75.52	59.59	
Oxide of Manganese	...	...	1.28	1.24	trace	
Oxide of Iron and Alumina	...	...	1.98	11.18	18.66	
Insoluble material	...	...	5.64	8.18	11.45	
Carbonic Acid	...	...	1.12	1.13	2.07	
Moisture; etc.	...	...	1.47	2.75	8.23	
Total	...	...	100.00	100.00	100.00	

**Cost of Liming.**—In 1922, when the present investigations were carried out, good small lime was in most cases the most economical form of lime for agricultural purposes. Excellent samples were examined both at the kiln and in the process of distribution in the field, which had been on offer at 12s. 6d. per ton on rail, as compared with lump lime at 32s. and ground lime at 52s. At the present time, however, similar small lime is bringing from 16s. to 17s. 6d., lump lime 35s., and ground lime 45s.; and there is therefore little to choose on the score of economy between small and lump lime, either of these being preferable to ground lime. In cases where the cartage is heavy, however, lump lime, despite its greater price per ton, may prove cheaper than small lime on account of the smaller quantity required. To the cost of the lime that of labour and

\* "Lime Burning on a Yorkshire Farm," by A. G. Ruston, B.A., D.Sc., this *Journal*, November, 1924.

† Leeds University Bulletin No. 107: "The Need for Lime on Yorkshire Soils," by Dr. J. A. Hanley.

distribution must be added; and while it is realised that these must vary considerably according to local circumstances, 10s. per ton may be taken as a fair average for the district, as rail charges over big areas are not incurred. Thus if 3 tons per acre of lump lime at 33s. per ton be applied, adding 10s. per ton for labour and distribution, the cost per acre amounts to £6 9s.; a further outlay of 30s. being required later when the land is in condition to receive slag. The total cost of the improvement thus amounts to £7 19s. Using 5 tons of small lime, in place of 3 tons of lump lime, the cost may be estimated as follows:—

	£	s.	d.		£	s.	d.
5 tons small lime at ...	...	16	0	per ton =	4	0	0
Cartage and distribution ...	...	10	0	per ton =	2	10	0
10 cwt. basic slag ...	...	3	0	per ton =	1	10	0
				Total	= 8 0 0 per acre.		

Thus, under ordinary circumstances, it appears to be immaterial which of these two forms is used at the present time.

**Results on White Bent Pasture.**—Rough white bent land responds but slowly to treatment, and the effect of the lime is sometimes not striking for three or four years. Frequently, however, close scrutiny will reveal some improvement in the second year, as evidenced by the breaking up of the mat, the greener appearance of the herbage, the decreasing prominence of white bent, heath bedstraw, and tormentil, and the presence of small clover plants here and there. On the other hand, such treatment on sound land, particularly if of the heavier type, will, when helped by judicious and skilful mixed stocking, maintain a state of fertility for as long as forty years. Occasional further and lighter dressings of basic slag will effectually prevent any deterioration from taking place.

As an example of the duration of the action of lime alone, reference may be made to Case B. Although in this instance the soil is by no means heavy the effect of lime is still very evident sixty years after its application. From information obtained, it is certain that little deterioration, if any, had taken place up to ten years ago; but latterly the soil has shown signs of becoming exhausted of lime once more, as indicated by the reappearance of such weeds as heath bedstraw, field woodrush, and sheep's sorrel (*Rumex acetosella*), the reduction of the percentage of clover and a tendency to mat-formation.

It is probable that the "lime alone" portion of Case A. Table I. is also beginning to revert. This portion was limed in 1874, and has thus remained in good condition for about fifty



TABLE I.—WHITE BENT LAND.

Case.	Altitude.	Soil and Geological Formation.	Treatment.	Botanical Analysis, 1922.				Rental Value per Acre.
				Legumi- nosæ.	Better Grasses.	Inferior Grasses.	Weeds and Bare Spaces.	
A.	600 ft.	Sandy loam overlying Grit. 2 in.—3 in. mat	None Limed 1874 (5 tons lump lime per acre) Slagged 1922 ..	per cent. Nil	per cent. 16.3	per cent. 63.4	per cent. 18.7	5/-
				17.5	30.0	37.7	12.9	15/-
				24.8	33.2	28.5	11.8	20/-
B.	600 ft. rising to 800 ft.	Light loam from gritty drift of Boulder Clay overlying Millstone Grit. 1½ in.—2 in. mat	None Limed 1862 (6 tons lump lime per acre)	Nil	14.0	46.2	39.8	5/-
				5.7	36.8	37.9	18.7	
C.	600 ft.	Gritty loam overlying Millstone Grit. 2 in.—3 in. mat	None Limed 1913 (5 tons small lime per acre)	Nil	21.3	51.0	27.0	5/-
				31.3	41.5	16.2	9.8	25/-

TABLE II.—AGROSTIS PASTURE.

Case.	Altitude.	Soil and Geological Formation.	Treatment.	Botanical Analysis.				Rental Value per Acre.
				Legumi- nosæ.	Better Grasses.	Inferior Grasses.	Weeds and Bare Spaces.	
G.	850 ft.	Heavy loam derived from Millstone Grit shale. 1½ in. mat	None Limed 1920 (2 tons lump lime per acre) Slagged 1920 (10 cwt. 38 %)	per cent. 1.4	per cent. 14.3	per cent. 30.4	per cent. 53.5	?
				5.6	39.2	30.7	22.5	?
				36.0	28.6	17.7	16.1	?
H.	850 ft.	Good loam overlying Limestone. 2 in. mat	None Limed 1908 (6¼ tons small lime per acre)	.1	33.4	41.1	23.4	7/6
				29.7	42.5	18.8	7.1	22/6

years. As will be seen from the botanical analyses, a dressing of basic slag applied to the limed area in 1922 has not only checked any tendency towards deterioration, but has effected a big improvement. It is a common experience in this district that slag applied to land which has been limed many years ago produces an excellent result.

**Profit Obtained from Liming.**—It may be calculated that lime followed by slag will, over a period of 45 years increase the rental value of the pasture by from 10s. to 15s. per acre, per annum, for 40 years of that period; or from 9s. to 13s. 4d. for the whole. Reckoning the cost of treatment at 160s. per acre, and the interest on this sum at 5 per cent. per annum (i.e., 8s.) it will be seen that, where the improvement is calculated at 13s. 4d. per acre, the profit according to the enhanced rental value is 5s. 4d. per annum; and where the improvement is estimated at 9s. the profit is 1s. The actual profits occasioned by the better grazing produced and its effect upon the stock will, however, be considerably greater than these figures indicate; and there is no doubt that, although there are areas of land difficult of access, where the labour involved is too costly to permit of profitable liming, there are also extensive tracts which can, at present prices, be economically improved.

**Treatment and Results with Agrostis Pasture.**—The treatment of Agrostis pasture is not so straightforward as that of white bent land. There are large areas of Agrostis pasture in the West Riding which, like white bent land, need lime, and will not respond to slag without it. On the other hand, there are numerous examples of the success of slag alone on such land (see Case G, Table II), and observations in the district tend to show that on certain types of Agrostis land heavier dressings of slag would probably give a satisfactory result where the customary 10 cwt. fails. Agrostis mats differ greatly not only in depth but in their constitution; and as to some extent the lime requirement varies accordingly, the latter is no doubt some index to the mode of treatment to be pursued. Where the mat seems sufficiently open in texture, or thin enough to allow water to penetrate, the probability is that slag will be successful. There are cases of Agrostis pasture where the mat is not thick, or not very dense, and the underlying soil is suitable, when slag may with confidence be advised. There are others where the mat exceeds 2 in. in depth and is tough and



impenetrable, when it may be stated decisively that slag will produce no result. Between these extremes many instances occur in which it is impossible, without experiment, to decide whether or not basic slag will prove successful; and in all such cases a safe method is to apply an initial dressing of lime and to follow it with basic slag two or three years later. Often as little as 1-2 tons of ground burnt lime, or 2-3 tons small lime, or 2-4 tons ground limestone per acre is a sufficient dressing to open the way for slag. Lump lime, if less than two tons per acre be required, is not recommended on account of the difficulty of even spreading.

In general *Agrostis* pastures are more amenable to treatment than white bent land, and rather lighter dressings of lime may be used. Except on the worst types where the mat is more than 3 in. in thickness (which are not common in the district under consideration) dressings of 2-2½ tons of lump lime, or the equivalent application of small lime, with a subsequent dose of slag, will be found sufficient.

It is interesting to notice (vide Case H, Table II) that fields on the Mountain Limestone formation frequently respond to lime as well as those on other soils in this district. Wherever there is a depth of more than 6 in. of soil, even though limestone may be the underlying rock, the herbage may show all the evidence of lack of lime.

The tenant in Case H found that since the application of lime his sheep, particularly the lambs, thrive much better than previously; and that whereas before the improvement the field would carry only in-calf cows, it was now able to support cows in milk during the best months of the year. In view of the fact that such an experience is by no means uncommon in the district, it is interesting to speculate as to how far the addition of lime to impoverished soil affects the lime content of the herbage, and ultimately influences animal metabolism.

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## ENSILAGE.—VI: THE CHEMISTRY OF SILAGE.

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THE unfortunate history of the earliest attempts to make silage in this country lends point to the contention that the successful inclusion of ensilage in farming practice must be based on an intelligent understanding of the changes which occur during the preservation of crops by this method. It will therefore be the endeavour of the writer in this article to deal with certain chemical and nutritional aspects of the silage question in as simple a manner as possible, avoiding, as far as is practicable, the use of technical phraseology.

**The Changes which occur in a Crop during Ensilage.**—The changes which modify the character of a green crop during its conversion into silage are brought about by the operation of three factors :—

(1) *The Respiration of the Living Plant Cells.*—When the chaffed crop is filled into the silo, the cells of the plant material continue to live for some time, and their respiration activity leads to a portion of the carbohydrate of the crop (sugar, starch, etc.) being converted into carbon dioxide and water by combination with atmospheric oxygen. This change is accompanied by the production of heat, the latter being responsible for the familiar phenomenon known as self-heating in the mass of material. It is clear therefore that heating implies destruction of carbohydrate and the loss of important nutrient matter. The new electrical process for making silage seeks to obviate self-heating and the consequent loss of carbohydrate by causing the temperature of the chaffed fodder to be raised artificially to 50° C. (122° F.) by the passage of the electric current; at this temperature the plant cells die and respiratory activity is no longer possible.

In view of the fact that respiration is an oxidative process, it follows that the extent to which the change occurs will depend largely on the supply of air remaining in the crop after filling into the silo. Thus, if the crop is comparatively dry, it does not pack so tightly and consequently more air is retained. In such a case, a relatively high temperature may be attained in the silo. A similar result will be obtained if the process of filling the silo is carried out in stages instead of continuously. On the other hand, the ensiling of an immature sappy crop, which



settles down compactly and thereby leads to a more thorough exclusion of air, is usually associated with a low temperature rise. These considerations are of importance in view of the influence of the temperature of fermentation on the quality and type of the resulting silage.

(2) *The Activity of Plant Enzymes.*—All fresh plant materials contain substances known as enzymes, which continue to act after the death of the plant cell and which are able to bring about a breakdown of the complex constituents of the crop in much the same way as the ingredients of a foodstuff are broken down during digestion. During ensilage, for instance, the protein constituent of the crop is acted on by enzymes and to an appreciable extent is converted into the same simple materials (amino acids) as are produced when protein is digested in the animal organism. It should perhaps be pointed out that these amino acids are for the most part neutral substances and are in no way responsible for the acidity of silage. The protein of the crop may therefore be regarded as undergoing, in part, a pre-digestion in the silo, though it is questionable whether any particular advantage attaches to this change from the point of view of nutrition. It is of interest to note in passing the claim put forward on behalf of the electro-silo, namely, that it enables the protein of the crop to be preserved in an entirely unchanged condition.

(3) *The Activity of Bacteria and Fungi.*—The production of organic acids is perhaps the most characteristic feature of the changes occurring in the silo. This is partly attributed to the incomplete oxidation of carbohydrate during cell respiration in an insufficient supply of oxygen, and partly to the action of micro-organisms on the carbohydrate of the crop. The organic acids which may arise during the conversion of a crop into silage are :—

- (a) Acetic acid (the acid of vinegar, possessing a sharp acidic smell);
- (b) Propionic acid (similar in properties to acetic acid);
- (c) Butyric acid (contained in rancid butter and possessing an offensive smell); and
- (d) Lactic acid (the acid of sour milk, possessing little or no smell, but having a sharp acidic taste).

(a), (b) and (c) are usually referred to as volatile acids, whilst lactic acid is termed a non-volatile acid. With sour silage, the lactic acid is present in smaller amount than the sum of the volatile acids, the latter being mainly composed of butyric acid. In nearly all cases of unspoiltd tower silage, however, lactic acid is present in excess, often very appreciable, of the volatile acids.

the latter consisting almost wholly of acetic acid. *In properly made tower silage, butyric acid should be entirely absent.* These features are brought out in Table I, which gives typical figures for the amounts of organic acids present in good maize silage.

TABLE I.—ACIDS IN MAIZE SILAGE.

	<i>Per cent. of moist silage.</i>				
Acetic acid	...	...	...	...	0.41
Propionic acid	...	...	...	...	0.04
Butyric acid...	...	...	...	...	0.00
Lactic acid	...	...	...	...	0.89

Much work still requires to be done in regard to the elucidation of the factors which determine the course of fermentation in the silo. A promising line of investigation is suggested by the possibility of being able to bring about a desired kind of fermentation by inoculating the green fodder with preparations containing pure cultures of bacteria. Amongst a number of partially established results, one fact stands out as having been demonstrated with a fair degree of certainty, namely, that the fermentation is dominated by the lactic bacteria when the temperature in the silo rises above 50° C. (122° F.). Such a condition is unfavourable to the activity of other types of micro-organisms, and it is this consideration which explains the production of sweet silage in the stack and in the electro-silo. On the other hand, when only low temperatures are attained (as with succulent, immature forage) the course of fermentation is more uncertain, and sour silage, containing the offensive-smelling butyric acid, may result.

It cannot be too strongly emphasised, however, that the production of good silage may also be associated with low temperatures of fermentation, as is the case with two excellent types of oat and tare silage, namely, the green fruity and acid brown varieties. In the production of these types, however, due care must be exercised in ensiling the crop at the proper stage of maturity.

The foregoing account by no means exhausts the possibilities in regard to bacterial activity in the silo. It is recognised that the less resistant forms of fibre (cellulose) may be attacked and broken down by bacteria. Furthermore, where the temperature of fermentation is low, certain undesirable micro-organisms may become active and bring about changes of a putrefactive character, giving rise to ammonia and allied substances of a useless and sometimes harmful character. These changes are brought about at the expense of the valuable protein



constituents and their digestion products, and abundant evidence of such activity is obtained when sour clamp silage is submitted to analysis. In all types of unspoilt tower silage, however, the amount of ammonia is exceedingly small. Other fermentative changes may lead to the production of small amounts of fragrant-smelling substances which confer on the silage an extremely pleasant and palatable character. Such changes occur during the production of green fruity oat and tare silage.

Another interesting change, strictly chemical in character and possessing no nutritional significance, is that which concerns the chlorophyll constituent. As a consequence of the action of the organic acids arising during preservation, the green pigment is transformed into a magnesium-free pigment (phaeophytin). Since the latter may exist in forms varying in colour from olive green to yellowish-brown and brownish-black, it follows that the colour of silage does not constitute a safe guide in regard to quality.

Before dismissing this phase of the subject, a word may be said on the subject of mould in silage. Spoiling by mould activity only occurs when air is permitted free access to the chaffed crop. In such a case the mass may become distinctly alkaline instead of acid and the material is thereby rendered unfit for consumption. In the tower silo, however, this type of activity only affects the surface layer, and good acidic silage is encountered at a depth of a few inches. In the making of stack silage, on the other hand, considerable wastage may occur as a result of mould action, especially if the stack be carelessly finished off.

**Feeding Value of Silage.**—The older literature on the subject gives the impression that silage necessarily possesses an appreciably poorer nutritive value than the green crop from which it is made. This impression still lingers in the minds of many farmers, who on that account are inclined to regard ensilage as a practice only to be adopted when it is forced on them by adverse weather conditions. Although the sour silage characteristic of the early attempts to make silage in this country undoubtedly possessed a feeding value decidedly inferior to that of the green crop, it is necessary to bear in mind that such material would nowadays be regarded as partially spoilt silage. There is every reason to believe that good tower silage is little, if at all, inferior in nutritive value to the green crop from which it has been made. Strong evidence in support of this view is afforded by the results of an investigation carried out

a year or two ago at Cambridge, when determinations were made of the digestibility of green oats and tares and also of hay and silage made from the oat and tare crop. The conditions of the experiment were so arranged as to make possible a fair comparison of the feeding values of the three types of fodder. Table II gives the results in terms of digestion coefficients. The reader should be reminded that the digestion coefficient of a given food constituent represents the number of parts of that constituent which are digested per 100 parts consumed. The silage was the green fruity type.

TABLE II.—DIGESTION COEFFICIENTS OF GREEN FODDER, HAY AND SILAGE FROM OAT AND TARE CROP.

	<i>Green oats and tares per cent.</i>	<i>Oat and tare hay per cent.</i>	<i>Oat and tare silage per cent.</i>
Dry matter ...	63.7	65.0	64.1
Protein ...	63.1	68.2	65.1
Crude Oil ...	51.9	36.8	73.4
Carbohydrate ...	76.5	71.3	70.5
Fibre ...	47.6	58.7	57.1

From the above data the following conclusions may be drawn:—

(1) The digestibility of the dry matter is of the same order in all three cases.

(2) There is no serious difference in the degree to which the protein of the three fodders is digested.

(3) The digestibility of the oil fraction is greatest in the case of the silage, though it must be remembered that the ether extract of silage is composed almost wholly of organic acids.

(4) The carbohydrates of the hay and silage are approximately of equal digestibility, and in both cases the digestibility is somewhat lower (but not to such an extent as was thought formerly) than that of the corresponding fraction of the green forage.

(5) The fibre constituents of the hay and silage are almost equally digested, but the fibre of the fresh green crop possesses an appreciably lower digestibility. This finding confirms the supposition that heating in the stack and in the silo leads to a definite increase in fibre digestibility. In view of the fact that such fodders contain large amounts of fibre, this increase of digestibility becomes of considerable significance.

If the productive values of the three fodders be calculated in terms of pounds of starch by the help of the digestion coefficients, it is found that the green fodder and silage possess almost equal nutritive value, whereas the hay is slightly inferior to both. This slight superiority of silage over hay has been confirmed not only by measurements of the available energy stored up in the two feeding-stuffs, but also by the results of long-period feeding trials carried out on the University Farm at Cambridge.



Interesting results (as yet unpublished) have been obtained recently in connection with the digestibility of sweet rye grass and clover silage made in the stack. The dry matter was found to be only 47 per cent. digestible, and a notable feature of the results was the abnormally low digestion coefficient of the protein, namely, 12.2 per cent. The silage contained 4.28 per cent. of protein and it follows that the content of digestible protein was only 0.52 per cent. It was demonstrated beyond doubt that a big depression of protein digestibility occurred as a result of changes taking place in the stack silo, and a tentative explanation has been put forward which is based on a consideration of the abnormally high temperature attained in this particular stack (viz.,  $80^{\circ}\text{C.} = 176^{\circ}\text{F.}$ ). The fall in digestibility may have been due to the exposure of the protein of the crop to this degree of heat over a protracted period and if, in the light of future work the explanation proves correct, it follows that there is a two-fold reason why the temperature of the stack should not be allowed to rise much beyond the temperature requisite for the production of sweet silage (viz.,  $50^{\circ}\text{C.} = 122^{\circ}\text{F.}$ ). An unnecessarily high temperature implies undue destruction of carbohydrate and may further cause an appreciable depression of the digestibility of the protein constituents

**Losses of Nutrient Constituents in the Silo.**—From what has been said, it is clear that the ensilage of a crop must result in losses of nutrient matter (*e.g.*, carbohydrate), but that the residual silage, if unspoil, need not possess, weight for weight of dry foodstuff, a feeding value much inferior to that of the green crop. In considering the losses which are incidental to ensilage, it must also be borne in mind that losses of a similar magnitude occur during the conversion of a green crop into hay. In Table III are shown the average results of several investigations into the changes which occur during the conversion of oats and tares into green fruity and acid brown silage.

TABLE III.—GAINS OR LOSSES IN SILAGE PRODUCTION.

	<i>Green fruity silage.</i> percentage gain or loss.	<i>Acid brown silage.</i> percentage gain or loss.
Dry matter ... ..	—11.2	— 7.7
Crude protein (including amides)	— 8.2	0.0
Crude oil (mainly organic acids)	+52.4	+45.0
Carbohydrate ... ..	—19.1	—14.7
Fibre ... ..	— 5.5	— 6.0
Ash (inorganic salts) ... ..	— 9.2	0.0
True protein (crude protein minus amides) ... ..	—41.0	—28.4
Amides (mainly digestion products of true protein) ...	+85.3	+96.0

The general significance of the data in Table III will be appreciated in the light of what has been written in the first section of this article. The figures bring out very clearly the essential differences between the chemical processes by which the two kinds of silage are produced. The loss of dry matter is greater in making the green fruity silage than that associated with the production of the acid brown type. This difference is largely a result of the more copious drainage which accompanies the ensilage of the less mature and more succulent crop, and further evidence of this is afforded by a study of the losses of crude protein and inorganic salts. Appreciable losses of these constituents occur in the production of green fruity silage, whilst with the acid brown variety the losses are nil. Conditions of immaturity appear to favour the splitting up of carbohydrate and true protein, and the figures for amides show that drainage away of juice must deprive the green fruity silage of substantial amounts of these soluble nitrogenous products.

The question of drainage from the silo is an urgent problem awaiting satisfactory solution. Work at Aberdeen has demonstrated that very large amounts of phosphates and lime and potash compounds may be lost as a result of juice drainage, and it follows that only by reducing the running off of juice to a minimum can the valuable inorganic constituents of the green crop be conserved. In this connection it is claimed that if a crop be ensiled in a concrete silo not provided with a drain, the expressed juice which would otherwise run off and be wasted is ultimately reabsorbed by the mass of silage. This points the way to the production of any type of silage with minimum losses, though it is not by any means certain that the retention of large volumes of acidic juice in this manner would affect the palatability of the silage beneficially. Furthermore, if the silage were used for stock at too early a date after filling, there might be a danger of the material in the lower part of the silo being very wet. The whole question of drainage from the silo is receiving attention at the present time.

The cutting of an oat and tare crop at a comparatively immature stage for the production of green fruity silage means not only bigger losses of dry matter during ensilage, but also the ensiling of a smaller weight of forage per acre than would be dealt with if the crop were cut at a maturer stage for acid brown silage. Against these considerations, however, must be set the fact that green fruity silage is distinctly superior to the acid brown type in regard to palatability, digestibility and



nutritive value, the feeding values being roughly in the ratio of 7:5.

As might be expected, the biggest losses of dry matter are associated with the production of sour silage. In the making of sour clamp silage from oats and tares, a 20-25 per cent. loss was measured, this figure representing the combined effects of fermentation and drainage and not taking into account actual wastage by spoiling. The smallest loss hitherto recorded in the Cambridge investigations was a 5 per cent. dry matter loss during the conversion of sunflowers into silage. The latter, however, was of a fibrous and woody nature, and on that account was little relished by stock.

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## RATS.

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By far the most injurious animals in Britain are the rats, and in spite of the energetic measures taken to reduce their numbers they remain a very serious menace. They destroy enormous quantities of stored food, and spoil much more than they destroy; they do great damage to property by burrowing and gnawing; and they are vehicles of several formidable diseases. They multiply prodigiously, and there is probably one rat at least for each member of our population. They are continually being introduced afresh from foreign countries.

**The Black Rat.**—Neither of the rats now represented in Britain can be called a native. Both are aliens from the East, and the first to come was the Black Rat (*Rattus rattus*), whose arrival in this country dates from the time of the Crusades. In the Mediterranean region and in the East it is represented by varieties of a much lighter colour. Thus the Alexandrine variety, frequenting Asia Minor and North Africa, is brownish-grey on the back, and the Roof Rat of the Mediterranean region has the same part of its body yellowish- or reddish-brown. It seems that the black dress was acquired after the originally light-coloured *Rattus rattus* got a footing in colder countries, but it

must be kept in mind that many of the "Black Rats" (*Rattus rattus*) in Britain are actually brown, and many of the "Brown Rats" (*Rattus norvegicus*) are black. This is a source of frequent confusion, and shows that little importance can be attached to the colour until the species has been identified on other grounds, to be referred to later. For many years the black rat was a serious pest in Britain, as in Europe generally, not only because of its destructiveness but because it harboured the microbe of the plague (or Black Death). In the early eighteenth century, however, its rival the brown rat was introduced, and within fifty years this newcomer had prevailed. About the middle of the nineteenth century the black rat was a great rarity in Great Britain. In several places, *e.g.*, at Yarmouth, it has become common again, being introduced afresh by ships. Its climbing powers favour its prevalence as a ship rat, and in this respect it is more successful than its cousin.

**The Brown Rat.**—The original home of the Brown Rat (*Rattus norvegicus*) is in temperate Asia, and wild forms are still abundant in the region between the Caspian Sea and Tobolsk, and also to the west of Lake Baikal. It has become closely associated with man, and has been his shadow wherever he has sailed. It was not known in Western Europe till 1716, nor in Britain before 1728. The colder the country the closer is the dependence of the brown rat on man.

Darwin referred to the internecine struggle for existence between the brown rat and the black rat, which resulted in the latter becoming almost extinct in Britain. But four points must be kept in mind: (1) the brown rat is the hardier species, more of an outdoor creature and indifferent to the wetness of sewers and the like; (2) the brown rat is more of a burrower, and therefore less baulked than the black rat by barriers of stone and lime; (3) the brown rat is a much more indiscriminate eater; and (4) it is more plastic and tamable, as is well seen in the behaviour of its albino derivative the "white rat." No doubt the two species will fight when they must, but it is too simple to say that the brown rat directly killed off the black rat in the struggle for existence. As Dr. Chalmers Mitchell says: "Each species has its different aptitudes, capacities and preferences, and each insinuates itself into the most suitable environment. Possibly the extension of sewers and drains in this country has been a major cause of the greater success of the brown rat." Moreover, we cannot forget that the black rat is becoming common again in some places.



### How to Distinguish Black and Brown Species.

#### BLACK RAT (*Rattus rattus*).

Smaller, of slim build, with sharp muzzle.

Ears large, naked, almost translucent, reaching or covering eyes when pressed forwards.

Tail slender, at least as long as head and body.

Pads on soles of feet relatively large.

Many slender grooved bristles in the soft fur. Usually ten teats.

Adult weight rarely over eight ounces.

#### BROWN RAT (*Rattus norvegicus*).

Larger, of heavier build, with blunt muzzle.

Ears small, hairy, thick, hardly reaching the eyes when pressed forwards.

Tail stout, never so long as head and body.

Pads on the soles relatively small.

Grooved bristles fewer and more slender. Usually twelve teats.

Adult weight normally 14-17 ounces.

The two species are nearly related, but they differ through and through—even in the crystals that form when their blood is dried. There are marked differences in the skulls and teeth, but to appreciate these requires some apprenticeship. For details we refer to M. A. C. Hinton's "Rats and Mice," in the British Museum Economic Series, 1918, price 1s., a very satisfactory guide. We must notice again that no reliance can be placed on differences in colour; and that differences in size and weight cannot be much utilised unless one knows that the contrasted animals are of the same age. A brown rat of thirty ounces is not uncommon, and one of 2 lb. 12 oz. has been recorded.

There should be no possibility of mixing up either of the rats with the Water Vole (*Arvicola amphibius*), badly called the "Water Rat." For the water vole is a heavily-built animal, marked by a broad head, a blunt muzzle, inconspicuous ears, and a tail with a good deal of hair. It is not infrequently found exploring in fields at a distance from the water.

**Habits of Brown Rats.**—Rats are most active in the darkness or semi-darkness. Their eyes can make much of dim light; and they have acute tactile sensitiveness in their whisker-hairs (or vibrissæ) and in their feet. They usually spend much of the day in their holes or burrows, resting and sleeping, and they often make comfortably lined nests. They often collect stores of food. In their coming and going in the open they make runs, which are marked by their spindle-shaped droppings. Their inclination to keep to these wonted paths makes trapping easier, but everyone knows of their suspicious wariness.

They are practically omnivorous, though vegetarian in wild conditions. The chisel-edged incisors are well adapted for gnawing, and part of the rat's activity in this direction, which

sometimes seems gratuitous, is necessary in order to keep the continuously growing incisor teeth from becoming too long. When the upper and lower teeth fail to meet properly strange overgrowths occur which sometimes end fatally. Rats may attack hard wood, lead pipes, bricks, and cement; but what they gnaw in such cases is not swallowed.

The brown rat is not such a clever climber as its cousin, but still it can do wonders. It is a better burrower than the black rat and is much more inclined to take to the water. It swims and dives well, and follows water-courses in spreading from place to place. Although it often lives among filth, it is by inclination a cleanly animal, and makes a habit of bathing whenever it gets a chance. There is often a spring movement of rats from human habitations to the open country and a return to shelter in autumn. There is often a vigorous hunting of small animals in the open and a not inconsiderable destruction of eggs and young birds. The seasonal movement is to be distinguished from a trekking from one locality to another when overcrowding becomes intolerable, or when something occurs that makes flitting desirable. There are records of a unanimous departure from a haunt where the mortality from poisoning had been great.

Rats are sociable among themselves, though there is evidently an instinct which prompts them to kill and devour the maimed or weakly. Records of their "courage" in attacking man are probably misunderstandings, for the circumstances usually point to the desperate boldness of starvation. Moreover such abnormalities of appetite as attacking the feet of elephants are apt to seem stranger than they really are, for it is very improbable that it occurs to the rat that it is gnawing at the toes of a giant mammal! There is no doubt, however, as to the resourcefulness, ingenuity, and educability of rats. They form associations readily and they can learn in a short time to scamper through the passages of a Hampton Court maze.

**Family Affairs.**—Brown rats may be sexually mature when three and a half or four months old, and they can breed all round the year. The sexual season for a particular female extends for about nine months, and "heat" occurs at intervals of about ten days. The male is always ready to pair. The female cannot be impregnated except at the period of "heat," which lasts for only a few hours. The period of gestation is about three weeks, and the female is ready to be impregnated within a few hours of the birth of a litter. The average number in a litter is eight, but there are often a dozen;



and there may be five or six litters in a year. The female ceases to be fertile as she grows older—a fact sometimes overlooked in estimating the rate of multiplication. She is a careful mother, but in conditions of overcrowding, inadequate food-supplies, or captivity, she may devour her offspring. The young are born blind and naked, with their ear-trumpets sealed down. Their eyes open in about a fortnight and they are weaned in the course of their fourth week. It will be understood that many of the figures, such as the number of litters in a year and the number of offspring in a litter, vary greatly according to the conditions of life.

**Numbers of Rats.**—Two female rats kept in captivity are known to have had in 13 months 26 litters, amounting altogether to 180 immediate offspring. But the young would begin to breed in  $3\frac{1}{2}$ —4 months, so that the total number of descendants would be much greater. A common estimate is that a pair of rats, with six litters of eight in a year, would, with equal sexes and no deaths, be represented by 880 at the end of the first year. At this rate, there would be many hundreds of millions from a single pair and their descendants in the course of five years. Of course this never occurs.

Writing in 1918, Mr. Hinton started from the assumption that there were forty million rats in Britain at the beginning of the year, that is about one per head of the population and about one per acre of cultivated ground. He supposed that twenty millions had a chance of breeding, and that 95 per cent. of the breeding pairs died in the course of the year. He further supposed that 50 per cent. of the progeny died at birth, and that only half of the survivors had a chance of breeding, and that the young effective rats were subject to a natural mortality of 95 per cent. in the course of their first year. Even then, under suppositions so very unfavourable to the rats, the ten million pairs at the beginning of 1918 would be represented by 41,000,000 by December 31st. The cost of keeping them would be over £9,000,000, and the indirect loss entailed by their presence would be enormously greater. Mr. Hovell says that “it would not be surprising if the damage sustained by Great Britain, say in 1923, approached one million pounds sterling per week.”

**The Indictment of Rats.**—To the farmer's interests rats are in many ways seriously hostile. They devour large quantities of grain and other foodstuffs, and foul even more. They attack root crops, and riddle stacks. They are hostile to pigs, poultry.

and pigeons. They do much damage to property, even to the extent of undermining walls. It is said that in 1909 alone £2,000,000 were spent in providing rat-catching or rat-killing apparatus.

But the indictment is still more serious when we think of rats in connection with disease. The blood of the rat often contains the microbe of the plague (*Bacillus pestis*), and this is disseminated by the rat-flea when the plague-stricken rat dies and the flea happens to pass not to another rat, as is usual, but to man. Even in these years of energetic action, the bacillus of bubonic plague occasionally occurs among black rats in British seaports.

The dangerous *Trichina* worm, which causes trichinosis in man, is primarily at home in the rat. When a pig eats an infected rat it becomes trichinosed, and from the pig's flesh if it is imperfectly cooked the parasite reaches man. Mr. Hinton notes that in one instance the flesh of a single pig, escaping the watchful eye of the inspector, caused 337 cases of trichinosis, and of these 101 terminated fatally.

Another horror is that the dwarf tapeworm (*Hymenolepis nana*), which is very common in man, has the rat as its preliminary host. Rats are also said to disseminate a form of infectious jaundice. Rat-bite may cause a peculiar and serious fever.

Issuing from filthy places the rat may contaminate the food of man and beast with its germ-laden droppings, and there is reason to suspect that it is the vehicle of an intestinal disease (a kind of dysentery due to an amœba) that troubles man. The circle of the rat's life cuts man's at many points, and always inimically, except that it affords a convenient animal for experimentation.

**Practical Measures Against Rats.**—In many cases of animals that are hostile to man's interests, especially when they become numerous, we can find some counteractive in carnivorous mammals and birds of prey; and there is no doubt that weasels and stoats, kestrels and owls, and some other creatures levy a useful toll on rats. Everything should be done to encourage these natural checks. But the rat menace in Britain has long since passed beyond being counteracted by the balance of nature. Millions of these pests are living under the shield of artificial conditions which favour their survival and increase. Yet the serious danger is being energetically faced, and there is no doubt that man can get the better of the rat as soon as he devotes adequate energy to the problem.



The preventive measures include the protection of foodstuffs in rat-proof receptacles; the rat-proofing of houses, stables, stores and stacks; the wiring of drains; the fumigation of ships and "rat-shielding" of hawsers with large circular discs; the replacement of wood by cement, concrete and brick in infested places; and, not least important, more careful disposal of refuse and reduction of the "crumbs," big and little, on which rats so largely feed.

The destructive methods are flooding, blocking, trapping, hunting and ferreting, the use of poisoned food (*e.g.*, with barium carbonate), and fumigating the holes and burrows with poison gas (requiring careful handling).

In regard to prevention and cure, we would make four general statements: (1) success in putting an end to a dangerous and disgraceful state of affairs will be in proportion to the unanimity of action all over the country; (2) mere reduction in numbers will not give more than temporary relief, if a substantial breeding stock is allowed to remain; (3) the extermination of mice should go along with the extermination of rats; and (4) no efforts are likely to be successful unless greater care is taken with the disposal of refuse and "crumbs."

See "The Destruction of Rats," Ministry's leaflet No. 244; "Rat Destruction: some Simple Suggestions," Ministry's Form No. 264/TK; "Rats: How to Exterminate them." Miscellaneous Publications of the Ministry No. 22, 6d., post free; E. G. Boulenger, "Report on Methods of Rat Destruction" (Zoological Society of London, price 6d.). A most admirable shilling's worth is Mr. M. A. C. Hinton's "Rats and Mice, as Enemies of Mankind," published by the British Museum, 1918. "Rats, and how to Destroy them" (Mark Hovell, London, 1924, pp. 465, 10s. 6d.). Attention should also be directed to the Rats and Mice (Destruction) Act of 1919, which makes it imperative on an occupier of land to destroy rats and mice and to protect the land from infestation.

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## SPRAYING EXPERIMENTS AGAINST APPLE SCAB.

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In the following article an account is given of spraying experiments against apple scab or black spot,\* which were

\* The Ministry's Leaflet 131, on Apple and Pear Scab may be profitably consulted by the fruit-grower on the subject of Apple scab and its control. Full information is given on such important practical points as the most susceptible varieties as well as the best fungicides to use to control the disease.

carried out during 1923 and 1924, in a commercial plantation at Egerton, Kent.\* The trees sprayed were bush trees of the variety Bismarck, planted in 1915. These comprised four rows of one block, which also contained rows of Beauty of Bath and Lane's Prince Albert, and was situated at the west side of the plantation. The trees were planted at 14 ft. square, with black currants underneath. The rest of the plantation, separated by a narrow grass path, consisted of similar trees of the varieties Bramley's Seedling, Annie Elizabeth, Beauty of Bath, Newton Wonder, Worcester Pearmain, Cox's Orange Pippin and Lane's Prince Albert. The soil was a stiffish loam. The plantation had become rather weedy during the war, and pigs had recently been brought in to root up the ground in preparation for more thorough cultivation. The four rows of Bismarck were separated from each other by alternate rows of either Beauty of Bath or Lane's Prince Albert, which protected them from accidental spray drift. All the rows of Bismarcks had suffered severely from scab in 1922. They were moderately well-grown trees which had made a fair amount of wood-growth and had cropped reasonably well during the last few years. The yearly pruning had consisted of leader-tipping from a third to a half and lateral spurring to three buds.

The actual spraying was carried out with one bamboo lance fitted with the Drake and Fletcher "Mistifier" nozzle provided with the smallest nozzle-disc, viz., number 0. The spraying machine (Weeks and Son) was provided with a lead consisting of one 60-ft. length of rubber hose piping and the power was supplied by a small 2-h.p. Emerson Brantingham petrol engine, with a 50-gallon tank, design to be drawn up and down the headland by a light tractor. The spray was applied at a pressure of from 90-100 lb.; and, at the different sprayings, from  $\frac{3}{4}$  to  $1\frac{1}{2}$  gallons of the spray fluid were applied to each tree. All the spraying was carried out by one person† so as to secure uniformity of treatment for each tree.

As regards spraying materials, the chemical composition of the two brands of lime-sulphur used was found to be as follows:—Brand No. I, sp. gr. 1.302, polysulphide sulphur, 18.49 per cent.; Brand No. II, sp. gr. 1.194, polysulphide sulphur, 10.16 per cent. The lead arsenate paste (Swift's) was found to contain 16.12 per cent. total arsenic oxide

\* We take this opportunity of thanking Captain R. D. Seoble-Hodgins for allowing us to carry out the experiments on his trees, and for kindly providing the necessary apparatus and labour.

† N. B. Bagenal.





FIG. 1.—Blossom trusses of Ecklinville showing the first outbreaks of scab on the earliest leaves at xx. This type of infection occurs on the variety *Bismarck*.

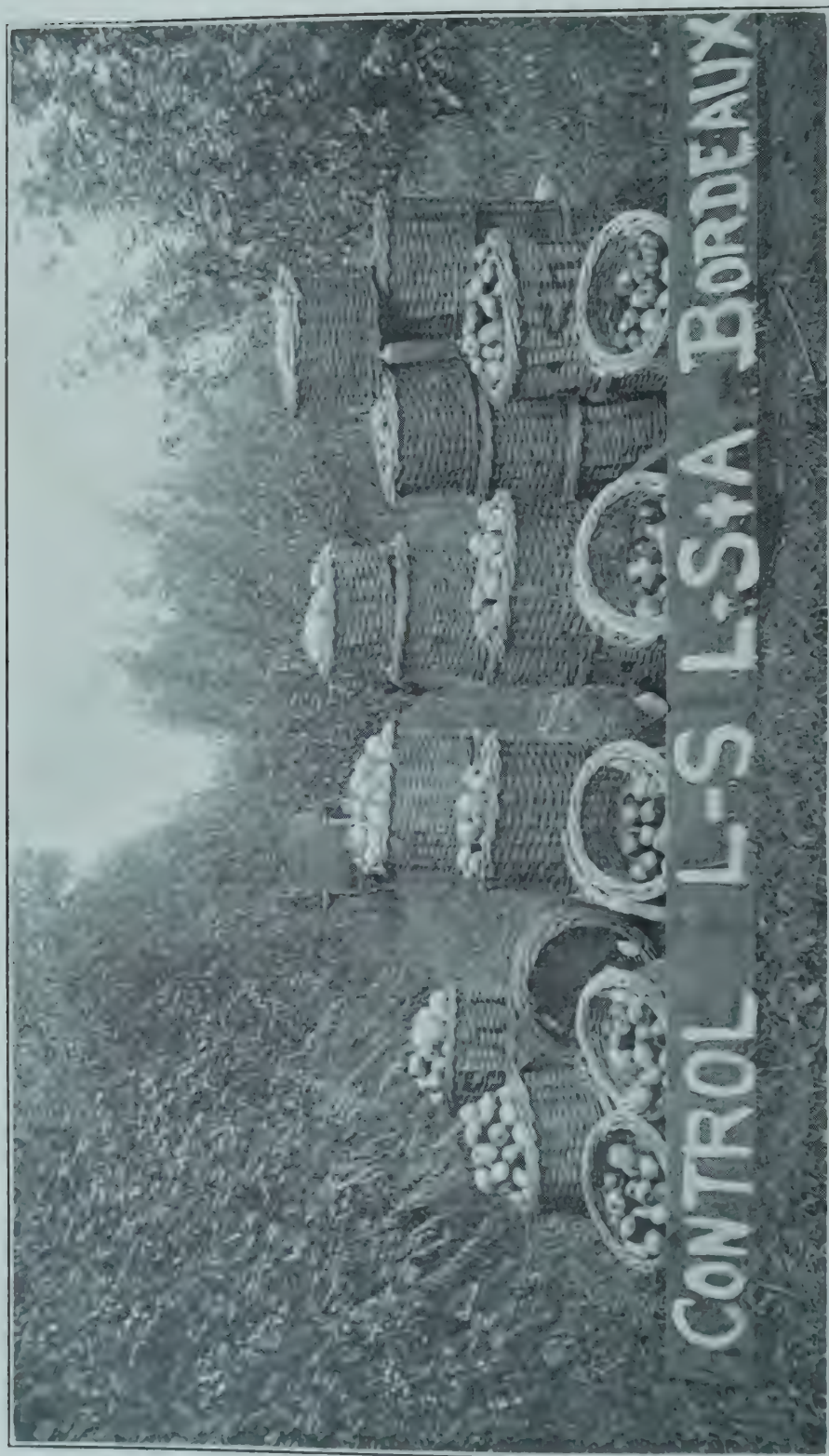


FIG. 2. The entire crop of apples from the sprayed trees, showing result of grading the fruit.  
 No deduction can be made from this illustration as to any effect of the different sprays on yield, but their relative efficiency in controlling black spot may be judged by comparing the amount of fruit in Grade 3 (front row), Grade 2 (middle row) and Grade 1 (back row).

This is as follows :

	Gr. 3	Gr. 2	Gr. 1	Total
	lb.	lb.	lb.	lb.
Bordeaux -	18	85	291	394
Lime-Sulphur and Arsenate of Lead	14	90	125	229
Lime-Sulphur -	14	81	125	220



( $\text{As}_2\text{O}_5$ ), and 0.23 per cent. water-soluble arsenic ( $\text{As}_2\text{O}_5$ ). The lime-sulphur used with the arsenate of lead paste was Brand No. II in 1923, and Brand No. I in 1924, and the manner of mixing the two constituents was as follows:— 1 gallon of the concentrated lime-sulphur was mixed with 28 gallons of water, the further gallon—making 1 : 29—being used to make the lead arsenate paste—1 lb. 5 oz. (equivalent to 4 lb. lead arsenate paste to 100 gal. wash)—into a thin cream. The diluted lime-sulphur and lead arsenate were then mixed together and at once transferred to the spray tank.

The Bordeaux mixture was made on the formula:— 8 lb. copper sulphate, 8 lb. quicklime, 100 gal. water.

1923.—The first applications of the sprays were given on 23rd and 24th May,\* when the trees were just out of flower. Since the trees had previously been found to be practically free from scab pustules on their young wood, it had been expected that at this date the various spray fluids could be applied to still quite healthy leaves to protect them from any subsequent infection. Such, however, was far from being the case. Inspection at this date showed that the scab fungus was already firmly established on many of the trees. The disease occurred sometimes as a few scattered spots of scab on some of the leaves, particularly those situated round the flower-spur, which are the earliest to appear in the spring. Not uncommonly, however, the leaves at the tips of the branches showed the disease, and in some cases these were so severely affected that nearly the whole upper surface of the leaf was uniformly black or sooty with the summer-spores of the fungus; in other cases the margins of the leaf had been attacked so vigorously that it was beginning to shrivel up.

The second sprayings were made on 15th June, under favourable weather conditions.

No spray injury to the foliage, of any economic importance, was observed. Some of the leaves of the trees sprayed with lime-sulphur showed an injury on the upper surface in the form of dark violet patches which were brown below; while many of the leaves (both young and full-grown) on the trees

\* The lime-sulphur wash (Brand II) was applied on the morning of 23rd May, and the operation was finished at 1.30. Rain fell continuously from 2.30 onwards. It was concluded, from an examination made on 24th May, that the wash had dried on the leaves before the rain came, since these leaves were well covered with the dried spray-deposit.

sprayed with Bordeaux mixture showed the characteristic small reddish-purple spots. In no case did any shrivelling or leaf-fall result.

By 28th July a considerable number of small apples were to be found lying under the sprayed trees. The number under each tree was counted and the results tabulated. Owing to the fact that this fall of the fruit took place from some of the control trees also, and that the latter bore so little fruit, the data collected proved insufficient to allow of any inference being safely drawn as to whether the spray fluids used could

The trees used in the experiment produced but little fruit; all the apples were, however, graded. From the results shown in Table I, it is clear that all the fungicides used controlled the disease to a considerable extent. If the crop of the control trees be taken row by row, and compared with that of the trees in the same row sprayed with the various fungicides, it will be seen that the number of apples in Grade I, *i.e.*, apples entirely free from scab, is very considerably less—from 15 per cent. to 75 per cent. Comparing the relative efficiency of the fungicides used, Bordeaux mixture and lime-sulphur plus arsenate of lead applied to the trees in rows 2 and 4 controlled the scab better than did lime-sulphur, as shown by higher percentages of scab-free apples (averaging 70 per cent. for Bordeaux mixture and 77 per cent. for lime-sulphur plus arsenate of lead as against 47 per cent. and 40 per cent. for the two brands of lime-sulphur). With the trees of row 3, where the attacks of scab were less severe (the control trees giving 40 per cent. of apples in Grade I) the beneficial effects of the different fungicides used were approximately equal, the *increased* percentage of apples in Grade I, due to spraying, being as follows:—Bordeaux mixture, 24 per cent.; lime-sulphur plus arsenate of lead, 16 per cent.; lime-sulphur, Brand I, 16 per cent.; lime-sulphur, Brand II, 19 per cent. In row 1, the trees sprayed with lime-sulphur plus arsenate of lead gave 47.8 per cent. of apples in Grade I, and those sprayed with lime-sulphur, 45.2 per cent.; while the control trees gave 25 per cent.

While it was obvious that the amount of fruit graded was too small to allow of the relative efficiency of each fungicide being determined with accuracy, it seemed safe to conclude from the facts observed during the 1923 experiments that two post-blossom sprayings with any of the three fungicides, Bordeaux mixture, lime-sulphur plus arsenate of lead, and lime-sulphur, materially



increased the proportion of apples entirely free from scab (the increase varying from 15 per cent. to 75 per cent.).

1924.—The plantation was examined earlier than in 1923. On 1st May most of the leaves surrounding the trusses of flowers, which were in the advanced pink-bud stage (*see* Fig. 1), were more or less fully expanded. On several of the trees at this date the scab fungus was found on a few of the leaves surrounding the flower-spur. The fungus formed small, brownish blotches or spots (or more rarely dark lines about the midrib) on the under-surface of the leaf and usually near its tip (*see*  $\times$  in Fig. 1). Most of the leaves which bore the spots of scab were situated by those flower-spurs which were nearest to the ground, but in one case the infested leaf was at a spur high up in the tree. On microscopic examination the scab spots were found to be producing thousands of summer-spores (*conidia*).

In many cases it could be seen that the leaf-tissue underlying the scab spot was brown and dead, suggesting that the infection must have taken place some days or weeks previously.

The question of the primary source or sources of infection with apple scab each season in fruit plantations may be briefly discussed here. Until 1924 the only stage known in this country in which the fungus persisted through the winter was that on the young (one-year-old) wood of certain susceptible varieties of apples. On the Bismarck trees used in the experiments, however, examination of the young wood during the winters of 1922-23 and 1923-24 showed that it was almost or quite free from scab pustules. In the same plantation, at a distance of about 75 yards, there were rows of Cox's Orange Pippin very severely affected on their young wood; and it is, of course, possible that summer-spores from the pustules on these trees may have been carried to the leaves of the Bismarck variety at the end of April, 1924, and started the disease there. A new fact, discovered in the early spring of 1924, however, indicated another very possible source of infection. The hitherto overlooked stage of the fungus was found, in which the spawn (*mycelium*) develops in the dead apple leaves during the winter and produces in the following spring fructifications containing winter spores. These spores, discharged into the air, may reach the young apple leaves and give rise there to the primary outbreaks for the season. This stage (which was well known in the other apple-growing regions of the world, but had not

previously been recorded for this country)\* occurred commonly on dead scabbed leaves of the previous season in the plantation where the spraying experiments were carried out, and may well have accounted for the early appearance of scab on the trees.

The scheme of experimentation that had been planned was to supplement the two sprayings with the three fungicides used in 1923 with one additional earlier spraying, to be applied to approximately half the trees in each class, and to compare the results obtained from the two, and three, sprayings respectively. Fourteen trees were sprayed in each of the six classes, and eleven control trees were left unsprayed.

The bad weather, however, coupled with the fact that trees available for the experiments were strictly limited in number, made it impossible to carry out this programme. On 1st May, when the first application was attempted, the trees sprayed with lime-sulphur plus arsenate of lead received heavy rain before the spray fluid had dried on the leaves. The Bordeaux mixture, too, was applied under conditions which must have nullified its action, since heavy rain fell as soon as the operation was completed, and the spray on the leaves was in consequence greatly diluted, or possibly all washed off. The lime-sulphur wash, which was the first of the three spray-fluids to be applied, was the least seriously interfered with by the weather, and had probably become dry on most of the leaves before the rain came.

On 27th May, the second spraying was given to those trees which had been partially sprayed on 1st May, and on the same date the first spraying was given to the trees of the other plots. The weather was dry during the operation, with an over-cast stormy sky, but occasional periods of hot sunshine.

On 9th June the sprayed trees were examined, and the incidence of scab on the leaves was recorded. The disease was described as "practically absent," if all the leaves were free, or if only one or two leaves showed a small spot of scab; as "slight," if the majority of the leaves were healthy while occasional leaves showed spots of scab; as "bad" when the

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\* A detailed account of this stage of the Apple Scab fungus was published in this *Journal*, vol. XXXI, Sept., 1924. It was there remarked: "Whether the formation of the winter-stage of the fungus takes place every winter in this country, or only in those winters (such as the last, 1923-4) characterised by dry, cold weather, can be determined only by future observations." It is of interest to note that, following the wet, mild winter of 1924-5, the winter-stage has again been found. Dead apple-leaves, collected in Kent and in Devonshire during February, 1925, were found to contain in abundance fructifications of apple scab with mature winter-spores ready to be discharged.



leaves on some of the branches were sooty, *i.e.*, the scab patches were so numerous that a conspicuous blackened appearance was given to the surface of the leaf; as "very bad" when sooty leaves were general. In Table II the amount of disease is shown, row by row, in all the sprayed plots, and on page 145 that on the control leaves is recorded.

### Stonebridge Green Farm, Egerton; Spraying Experiments, 1923.

BISMARCK VARIETY.—Table I.

Spray fluid (applied twice)	No. of Trees in Experiment		No. of Apples picked	No. of Apples in Grade*			Percentage No. of Apples in Grade*			Weight of Apples	
	Row	No.		1	2	3	1	2	3	lb.	oz.
Bordeaux Mixture (8.8.100)	2	5	19	14	4	1	73.7	21.0	5.3	8	8
	3	6	14	9	5	0	64.3	35.7	—	5	4
	4	10	47	31	14	2	65.9	29.8	4.3	19	8
		21	80	54†	23	3	67.5	28.8	3.7	33	4
Lime-Sulphur, Brand II, 1:29 plus Arsenate of Lead Paste, 4 lb. to 100 gal. of wash	1	6	46	22	13	11	47.8	28.3	23.9	13	8
	2	5	84	66	17	1	78.6	20.2	1.2	37	3
	3	6	141	79	41	21	56.0	29.1	14.9	60	7
	4	10	153	115	30	8	75.1	19.7	5.2	73	8
		27	424	282	101	41	66.5	23.8	9.7	184	10
Lime-Sulphur, Brand I; 1:29	2	4	23	10	8	8	38.4	30.8	30.8	7	12
	3	3	70	39	25	6	55.7	35.7	8.6	26	8
	4	5	41	23	12	6	56.1	29.3	14.6	17	3
		12	137	72	45	20	52.5	32.9	14.6	51	7
Lime-Sulphur, Brand II; 1:29	1	6	42	19	16	7	45.2	38.1	16.7	16	5
	2	4	49	21	20	8	42.8	40.8	16.4	17	13
	3	7	51	30	19	2	58.8	37.3	3.9	20	5
	4	10	65	24	22	19	37.0	33.9	29.1	24	10
		27	207	94	77	36	45.4	37.2	17.4	79	1
Control (Unsprayed)	1	9	28	7	11	10	25.0	39.3	35.7	8	14
	3	4	20	8	9	3	40.0	45.0	15.0	8	2
	4	4	21	0	7	14	—	33.3	66.7	5	7
		17	69	15	27	27	21.8	39.1	39.1	22	7

\* Grade 1: Entirely free from scab; Grade 2: Scab spots few or many but apple not too seriously affected to be unmarketable; Grade 3: Apple so cracked or disfigured by scab as to be unmarketable.

† 7.5 per cent. of these apples showed a slight "russeting," or discoloured blotches on the skin of the apple. Such apples, while marketable, would not be fit for fancy grade purposes.

TABLE II.

Spray fluid applied.	Row	No. of Trees	Amount of Disease on Leaves on 9.6.24
<i>Bordeaux Mixture</i> applied twice	2	2	Slight to bad
	2	3	Practically absent
	3	2	Slight to bad
	3	3	Practically absent
	4	3	Practically absent
<i>Bordeaux Mixture</i> applied three times	4	1	Bad
	3	3	Practically absent
	3	3	Slight to bad*
<i>Lime-Sulphur</i> plus <i>Arsenate of Lead</i> twice	4	8	Practically absent
	1	2	Practically absent
	1	1	Slight to bad
	2	4	Practically absent
	4	1	Practically absent
	4	1	Slight to bad
	4	4	Slight to bad
<i>Lime-Sulphur</i> plus <i>Arsenate of Lead</i> three times	4	1	Bad
	1	3	Slight to bad
	3	5	Practically absent
	3	1	Slight
	4	4	Slight
<i>Lime-Sulphur</i> twice	4	1	Practically absent
	1	1	Slight
	1	2	Slight to bad
	2	3	Practically absent
	2	2	Slight
	4	2	Practically absent
	4	2	Slight
<i>Lime-Sulphur</i> three times	4	1	Slight to bad
	4	1	Bad
	1	1	Practically absent
	1	1	Slight
	1	1	Slight to bad
	3	5	Practically absent
	4	5	Slight to bad
	4	1	Bad

As the notes given in Table II indicate, spraying with all the fungicides used protected the leaves to a considerable extent from scab, which had then spread over the foliage of the unsprayed trees.

At this date it was observed that lime-sulphur did not control the disease on the leaves to the same extent as did Bordeaux mixture. On trees well sprayed with lime-sulphur it was not uncommon to find leaves where spore-producing patches of the scab fungus had spread and extended over the dried-on deposit of the spray. On the trees sprayed with Bordeaux mixture, the patches of scab were either dead or dying and no cases could be found where growth of the fungus was extending over the sprayed part of a leaf.

\* One of these trees had a slight amount of scab on one side while on the other side, which was next to a control tree, the disease was bad.



A slight scorching of the tips and margins of a few leaves was noticeable on some of the trees sprayed with lime-sulphur plus arsenate of lead, as well as on some of the trees sprayed with lime-sulphur alone. On most of those sprayed with Bordeaux mixture, many of the leaves showed minute spots of a pinkish or purplish colour, due to spray injury. In none of the cases, however, was the injury severe enough to cause any economic damage, and no leaf-fall resulted.

On 24th June the last sprayings—second and third respectively—were given to the trees. The weather was hot, sunny and dry. Owing to the imperfect working of the engine, the different sprays were applied at varying pressure, particularly in the case of the Bordeaux mixture. The engine finally broke down completely, and 10 trees in the Bordeaux-sprayed plot were left unsprayed until 27th June, when the operation was completed in dry, sunny weather, using the Vermorel Knapsack Sprayer.

Table III.—Showing the percentage of “dropped” apples, 1924.

	Bordeaux mixture twice	Bordeaux mixture thrice	Lime- Sulphur Lead Arsenate twice	Lime- Sulphur Lead Arsenate thrice	Lime- Sulphur twice	Lime- Sulphur thrice	Control no spray
Number of trees	—	—	3	3	3	3	—
Number of dropped apples	—	—	50	387	172	636	—
Number of apples picked	—	—	28	308	82	134	—
Percentage dropped	—	—	64.1	55.7	67.7	82.6	—
Number of trees	5	—	4	—	5	—	4
Number of dropped apples	14	—	39	—	81	—	10
Number of apples picked	90	—	47	—	96	—	85
Percentage dropped	13.5	—	45.3	—	45.8	—	10.5
Number of trees	5	6	—	6	—	—	4
Number of dropped apples	135	221	—	359	—	381	188
Number of apples picked	286	263	—	53	—	163	108
Percentage dropped	32.1	45.7	—	87.1	—	70.0	63.5
Number of trees	4	8	7	5	6	6	3
Number of dropped apples	12	120	339	355	352	738	128
Number of apples picked	115	402	13	190	14	75	178
Percentage dropped	9.4	23.0	96.3	65.1	96.1	90.8	41.5

On 24th July the plots were examined to ascertain whether any dropping of the fruit had occurred as a result of spraying. All apples, measuring from  $\frac{3}{4}$  in. diam. upwards, found on the ground under each tree, were counted.\* The number is given in Table III, together with the number of apples gathered from the trees at the final picking.

With regard to *Row 2*, it will be seen that the percentage of drops under the control trees was 10.5, and was practically the same as that of the trees sprayed with Bordeaux mixture (13.5), while the percentage rose to 45 with the trees sprayed with lime-sulphur alone or with lime-sulphur plus arsenate of lead. In *Row 3* there was a drop of 63.5 per cent. from the control trees, and 32 per cent. and 45.7 per cent. from the trees sprayed with Bordeaux mixture, while the percentage rose to 70 for the trees sprayed with lime-sulphur alone and to 87 with the trees sprayed with lime-sulphur plus arsenate of lead. In *Row 4* the drop from the control trees was 41.8 per cent.; from the trees sprayed with Bordeaux mixture twice and thrice, the percentage was respectively 9.4 and 23; with lime-sulphur twice and thrice, the percentage rose to 96.1 and 90.8 respectively; and with lime-sulphur plus arsenate of lead, twice and thrice, to 96.3 and 65.1. In *Row 1* (with no control trees) lime-sulphur, twice and thrice, gave 67.7 per cent. and 82.6 per cent., respectively, and lime-sulphur plus arsenate of lead, twice and thrice, 64.1 per cent. and 55.7 per cent.

It appears safe to conclude from the above figures that while the sprayings with Bordeaux mixture did not increase the normal percentage of drops from a healthy tree, the sprayings with lime-sulphur or with lime-sulphur plus arsenate of lead did induce an abnormal drop of the fruit to a very considerable extent. The increased percentage of drops due to spraying with these two fungicides cannot be exactly determined from the evidence available, owing to the variation shown by the control trees. The point must not be lost sight of that some of the drop from control trees may have been directly or indirectly due to very severe attacks of scab on those trees,† and that possibly the drop shown by the trees sprayed with Bordeaux mixture more nearly represents the normal from a perfectly healthy tree.

\* For this process, a small handrake was used wherever grass and weeds were thick enough to conceal the apples.

† The development of scab was so plentiful on the majority of the leaves of some of the trees that they looked, at a short distance, as though soot had been thrown over them. Many of the leaves showed their margins curled under the effects of the disease.



There was some evidence to indicate that the percentage of drops from individual control trees increased in proportion to the intensity of scab attack.

The crop of apples in 1924 was very unequal on the trees in the plots, and not by any means heavy. The number of apples, the weight, and the condition of the crop as regards scab (which was graded as in 1923) are shown in Table IV.

It will be seen that the percentages arrived at, when the crop is graded by weight—which is more the commercial method of valuing a crop—approximate very closely to those obtained by counting the apples. This indicates that the average weight of the individual apple in all three grades was approximately the same. Fully-grown apples occurred not only in the scab-free grade but also in Grade 3, the unmarketable condition (see Fig. 2).

In *Row 2* the unsprayed trees gave 28 per cent. of the total number of apples picked, free from scab; the trees sprayed with Bordeaux mixture gave 66 per cent., and with lime-sulphur or lime-sulphur plus arsenate of lead, 70 per cent.

In *Row 3* the control trees yielded only 11 per cent. of apples free from scab; the trees sprayed with Bordeaux mixture averaged 73 per cent., with lime-sulphur plus arsenate of lead, 94 per cent., and lime-sulphur alone 90 per cent.

In *Row 4* the control trees gave 23 per cent. free from scab; the trees sprayed with Bordeaux mixture averaged 71 per cent., with lime-sulphur plus arsenate of lead, 58 per cent., and with lime-sulphur alone, 23 per cent.\*

In *Row 1* certain spray fluids were compared against each other, with the following results:—Lime-sulphur plus arsenate of lead applied twice, gave 54 per cent. of apples free from scab, applied three times, 38 per cent.; lime-sulphur alone, applied twice, gave 45 per cent.; applied three times, 39 per cent. The sprays used appeared to control the scab which, according to the grading was undoubtedly present in this row to approximately the same extent. The relative efficiency of the two sprays was thus compared, although their *actual* efficiency in this particular row cannot be estimated in the absence of unsprayed trees.

\* The different results obtained with lime-sulphur in Rows 3 and 4 is probably to be attributed to the difference of intensity in the attacks of the scab in these rows. In Row 3, where 89.6 per cent. of the number of the apples were scab free, the fungus on the caves of all five trees, when examined on 9th June, was noted as "practically absent" (see Table II), while at that date the six similarly sprayed trees in Row 4, which gave only 17.3 per cent. of scab free apples, showed a severe infestation of the foliage (1 tree, "very bad," 5 trees, "slight to bad").

The main conclusion which can be drawn is, that as in 1923, all the fungicides used controlled scab to a considerable extent. Taking the averages given in Table IV, the control trees show only 21 per cent. of apples free from scab, and no less than 29 per cent. unfit for market; while with Bordeaux mixture (twice or three times applied) the averages are 74 per cent. and 73 per cent. of scab-free apples, with only 5 per cent. of apples unfit for market.

The curious fact that three sprayings with a fungicide gave in several cases less good results than with two, can only be explained by the supposition that the incidence of disease was greater on the trees sprayed three times, and that the unfavourable weather conditions prevailing when the extra (earliest) spray was applied to the trees, rendered that application ineffective.

**Summary.**—1. The scab fungus may occur on the leaves situated round the flower-spur of the Bismarck variety of apple before the blossoms open. In 1924 this primary infection of the leaves was well established by 1st May. It is most probable therefore that an application of a fungicide at the “pink bud” stage will be found of great value in controlling scab on Bismarck and certain other varieties.\*

2. The variety Bismarck is extremely susceptible to scab on the fruit and also on the leaves, which may become sooty under the attack. The percentage number of scabbed apples on the unsprayed trees in the plots varied in 1923 from 100 per cent. to 60 per cent., and in 1924 from 89 per cent. to 72 per cent.

3. Spraying with any of the three fungicides, Bordeaux mixture, lime-sulphur and lime-sulphur plus arsenate of lead controlled scab to a marked extent.

4. None of the above spray fluids produced any serious scorching injury to the leaves or serious russetting of the fruit.

5. Some evidence was obtained which indicates that both the lime-sulphur wash and the lime-sulphur plus arsenate of lead wash may cause a dropping of the young fruit. No dropping was caused by spraying with Bordeaux mixture.

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\* This has been found to be the case in experiments on Bramley's Seedling carried out by the writers during 1924, the details of which will be published later.



## Stonebridge Green Farm, Egerton; Spraying Experiments, 1924.

BISMARCK VARIETY.—Table IV.

Spray fluid	No. of Trees in Experiment		No. of Apples picked	No. of Apples in Grade			Percentage No. of Apples in Grade			Wt. of Apples	Weight (lb.) of Apples in Grade			Percentage Weight of Apples in Grade		
	Row	No.		1	2	3	1	2	3		1	2	3	1	2	3
Bordeaux Mixture applied twice	2	5	90	59	22	9	65.6	24.4	10.0	29	20	6	3	68.9	20.7	10.4
	3	5	286	229	51	6	80.1	17.8	2.1	84	67	15	2	79.7	17.9	2.4
	4	4	115	75	32	8	65.2	27.9	6.9	43	28	12	3	65.1	27.9	7.0
		14	491	363	105	23	73.9	21.4	4.7	156	115	33	8	73.7	21.2	5.1
Bordeaux Mixture applied thrice	3	6	263	173	79	11	65.8	30.0	4.2	93	62	27	4	66.7	29.0	4.3
	4	8	402	314	69	19	78.1	17.2	4.7	145	114	25	6	78.6	17.2	4.2
		14	665	487	148	30	73.2	22.3	4.5	238	176	52	10	73.9	21.9	4.2
Lime-Sulphur Brand I + Lead Arsenate applied twice	1	3	28	15	10	3	53.6	35.7	1.7	12	7	4	1	58.3	33.3	8.4
	2	4	47	33	13	1	70.2	27.7	2.1	19	14	5	0	73.7	26.3	—
	4	7	13	8	4	1	61.6	30.8	7.7	5	2	2	1	40.0	40.0	20.0
		14	88	56	27	5	63.6	30.7	5.7	36	23	11	2	63.9	30.5	5.6
Lime-Sulphur Brand I + Lead Arsenate applied thrice	1	3	308	116	164	28	37.7	53.2	9.1	98	39	52	7	39.8	53.1	7.1
	3	6	53	50	3	0	94.3	5.7	—	25	23	2	0	92.0	8.0	—
	4	5	190	105	72	13	55.3	37.9	6.8	70	40	25	5	57.0	35.9	7.1
		14	551	271	239	41	49.2	43.4	7.4	193	102	79	12	52.8	40.9	6.3
Lime-Sulphur Brand I applied twice	1	3	82	37	35	10	45.1	42.7	12.2	32	14	15	3	43.7	46.9	9.4
	2	5	96	67	25	4	69.8	26.0	4.2	41	28	11	2	68.3	26.8	4.9
	4	6	14	4	9	1	28.6	64.3	7.1	7	3	3	1	42.9	42.9	14.2
		14	192	108	69	15	56.3	35.9	7.8	80	45	29	6	56.2	36.3	7.5
Lime-Sulphur Brand I applied thrice	1	3	134	52	77	5	38.8	57.5	3.7	51	20	30	1	39.2	58.8	2.0
	3	5	163	146	17	0	89.6	10.4	—	63	55	8	0	87.3	12.7	—
	4	6	75	13	39	23	17.3	52.0	30.7	26	5	14	7	19.2	53.9	26.9
		14	372	211	133	28	56.7	35.8	7.5	140	80	52	8	57.1	37.2	5.7
Control	2	4	85	24	46	15	28.2	54.1	17.7	26	7	15	4	26.9	57.7	15.4
	3	4	108	12	54	42	11.1	50.0	38.9	33	5	18	10	15.1	54.6	30.3
	4	3	178	41	86	51	23.0	48.3	28.7	60	13	30	17	21.6	50.0	28.4
		11	371	77	186	108	20.8	50.1	29.1	119	25	63	31	21.0	52.9	26.1

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## DIPHTHERIA IN POULTRY (ROUP OR BIRD POX).

At the present time most investigators are agreed that avian diphtheria and bird pox are merely two forms of the same disease. It is also known under a number of other names, such as roup, diphtheria, diphtheritic roup, contagious epithelioma, chicken pox, contagious catarrh, canker, etc. It is very widespread, and is probably the commonest malady met with in adult fowls in this country.

**Causal Agent.**—This has been the subject of much research and has given rise to a great deal of controversy. It still remains a disputed question as to which of several particular agents described is the cause of the disease. The weight of evidence, however, points to the disease being due to a resistant filter-passing virus. Clinical evidence strongly supports the theory of a single virus, as the various forms may be observed in an infected flock at the same time.

**Birds Affected.**—Fowls and pigeons are particularly susceptible; it is seen frequently in turkeys, geese, ducks and guinea-fowl, and pheasants, quail and various wild birds may also be attacked. There is a great variation in individual susceptibility, young and well-bred birds being the least resistant, while some birds appear to have a natural immunity.

The immunity acquired from an attack of the disease varies in strength and duration. A severe attack produces a strong and lasting immunity, while a mild attack gives only a partial protection of short duration.

Flocks are most severely attacked during the autumn and winter months. In some outbreaks a small percentage only is affected and the death rate is low; in other cases the majority of a flock contract the disease, with a mortality up to 90 per cent. Factors which influence the mortality are the degree of exposure to infection, virulence of the virus, adverse weather conditions and insanitary houses.

**Mode of Infection and Method of Spread.**—Many of the conditions governing the route of infection are not fully understood. The virus is believed to gain entrance to the system either by an abrasion of the skin or by ingestion and to pass to the sites of predilection by way of the blood stream.

The disease is spread by direct or indirect contact of healthy and diseased birds, and may be carried by the hands, clothes or boots of attendants.



**Symptoms.**—The interval which elapses between actual infection taking place and the onset of the symptoms depends on the activity of this or that virus. It is generally from 3 to 12 days.

Three clinical forms of the disease are recognised :—

- (1) Avian diphtheria, characterised by the presence of false membranes in the mouth.
- (2) Bird pox, a diseased condition of the unfeathered parts of the head.
- (3) A combination of the forms on the skin and mucuous membranes.

(1) *Avian Diphtheria*.—The premonitory symptoms are dullness, loss of appetite, sneezing and an occasional hard cough. These are followed by a watery nasal discharge, which gradually becomes thickened and obstructs the nasal passages. The eyes are swollen, inflamed and discharge a viscid material which sticks the eyelids together. In many cases the head is swollen, on one or both sides, below and in front of the eye, due to an accumulation of exudate within the infra-orbital sinus. This condition is known as “one-eyed roup.”

Owing to the obstruction in the nasal cavity breathing occurs through the mouth, and the passage of air over the tongue causes a drying and hardening of the tip and sets up the condition popularly referred to as “pip.” The catarrhal symptoms are followed by the formation of false membranes in the mouth, throat and wind-pipe.

These false membranes are of tough, greyish or yellowish exudate which adheres very firmly to the underlying tissues, considerable force being required to detach them. The removal of the exudate leaves the underlying surface inflamed and ulcerated, and a new deposit is soon formed. The false membranes spread until eventually the whole of the mouth and nostrils are involved, and even the lungs and crop may be invaded. These deposits make swallowing difficult or impossible, barely sufficient air can be inhaled to support life, diarrhoea and emaciation occur from the absorption of toxic products, and death soon follows.

In acute cases death may occur from suffocation within a couple of days of the onset of symptoms from an accumulation of exudate in the opening of the wind-pipe. The duration of the disease, however, is usually from 2 to 3 weeks. Complete recovery may take place or the disease may assume a chronic form which lasts many months. When the eyes are involved

the birds become emaciated and die from starvation owing to their inability to see the food.

(2) *Bird Pox or Contagious Epithelioma*.—This form of the disease appears as warty-looking nodules on the featherless parts of the head, such as the comb and wattles, the eyelids and adjacent skin. In severe cases the lesions may spread over the feathered parts of the head and neck, outer surface of the thighs, and the points of the wings.

The lesions first appear as flat nodules, which increase in size until they attain the dimensions of a hemp seed or even larger; they have a tendency to coalesce into cauliflower-like masses. The nodules are firm, yellow in colour, gradually turning darker with age. When the lesions are confined to the skin of the head the health of the bird does not appear to be affected, and recovery usually takes place without treatment in 10 to 12 days.

(3) *Combined Form*.—The nodules on the head are often co-existent with diphtheritic lesions in the mouth and nasal cavity, and in such cases the mortality may reach 90 per cent.

**Treatment**.—When an affected bird is found, it should be isolated immediately. The healthy stock should be divided into small lots and the mouth and throat inspected daily. Birds showing the slightest signs of disease should be at once removed and isolated. The houses, fittings and utensils should be disinfected regularly during an outbreak. A minimum quantity of litter should be allowed, and it should be changed frequently. The drinking water should be renewed daily. The grain should be fed in troughs, and the use of dry mash hoppers discontinued. A separate attendant should be provided for sick birds; if this is impossible they should be dealt with last. The attendant should thoroughly disinfect his hands and boots before leaving the infected premises.

When only a small number of birds are affected, individual treatment may be carried out, with strict isolation.

The discharge should be removed from the nostrils by gentle pressure, and the nasal passages syringed out with a mild antiseptic solution. Suitable antiseptic solutions are 2 per cent. permanganate of potash, 3 per cent. boracic acid, or hydrogen peroxide.

The exudate should be removed from the eyes and 2 drops of a 20 per cent. solution of argyrol instilled into them twice daily.

Diphtheria lesions in the mouth may be treated with tincture of iodine after removal of the exudate. The opening into the



wind-pipe should be examined, and if any exudate is present it should be gently removed.

When a large number of birds are affected the best method of treatment is to submerge the head in a suitable antiseptic solution for a period of 30 seconds, keeping the mouth open and the beak elevated. This should be repeated twice daily.

Swellings under the eye should be freely opened and syringed out with an antiseptic solution until the contents are removed.

**Prevention.**—Infection may be introduced by the purchase of birds from infected flocks or by those returned from shows or laying tests. New purchases and returned birds should be isolated for one month, and examined frequently during that period, before being allowed to join the healthy stock.

The aim of every poultry-keeper should be the prevention rather than the cure of contagious disease; therefore, when dealing with the first few cases of an outbreak the policy of destruction is one which merits serious consideration. If the value of the affected birds is not great, it is both advisable and economical to destroy them and diminish the risk of virus accumulating and the disease spreading to the whole flock. The apparently recovered bird is always a possible source of infection, as it may have developed into a carrier of the disease.

In the majority of cases the effects of a severe disease, such as avian diphtheria, are never entirely eliminated. The bird remains weakened in constitution, and is likely, sooner or later, to fall a victim to some minor ailment which a more robust bird would easily overcome. The birds should be kept under good hygienic conditions, in dry well-ventilated houses and roomy runs.

**Disinfection.**—The virus is very resistant, and the most thorough measures are required for its destruction.

The first and most important part in the disinfection of an infected building is the thorough cleansing of the interior by scraping and sweeping. The droppings, scrapings and litter should be burned or mixed with quicklime and removed from contact with fowls.

The walls and roosts should be scrubbed with hot water containing caustic soda (10 per cent.) to remove all dirt and grease. This also acts as a disinfectant. The house may then be washed or sprayed with a disinfectant, such as 5 per cent. solution of carbolic acid, 2 per cent. solution of compound cresol, or 2 per cent. solution of formaldehyde. The infected runs should be top-dressed with quicklime at the rate of 2 tons to the acre, and,

where practicable, ploughed up and left vacant for six months. Dead birds should be burned or buried in quicklime.

*Note.*—Specimens for diagnosis may be sent to the Officer in Charge, Veterinary Laboratory, Ministry of Agriculture, New Haw, Weybridge, Surrey.

In the case of poultry a whole carcass should be sent, which should not be opened before despatch.

The name and address of the owner should be set out clearly on each specimen, and an explanatory letter sent by post to the same address.

Specimens must be packed in some waterproof material and enclosed in a box: otherwise the railway authorities may refuse to accept them.

The Ministry makes a charge for post-mortem examinations; for particulars see "Veterinary Tests for Poultry Diseases," this *Journal*, April, 1925, p. 81.

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## APHIDES ATTACKING VEGETABLES AND MARKET GARDEN CROPS.

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A NUMBER of kinds of plant lice or aphides may be found from time to time feeding on vegetables and market garden crops. Whilst some of these are only of occasional or local importance, other are more or less general pests and must be regarded by gardeners and market growers as of considerable importance. This especially applies to the Mealy Cabbage Aphid (*Brevicoryne brassicæ*), the Black Fly (*Aphis rumicis*) on beans and the lettuce aphides (*Amphorophora lactuæ*, etc.). The measures of control are in most cases very similar, but where any special feature is prominent, such is referred to.

**The Green Pea Aphid** (*Macrosiphum pisi*, Kalt.).—This large green fly or aphid is often very harmful to main crop peas and sometimes attacks broad beans and sweet peas. Clovers, lucerne and trefoils are often heavily infested. In America it is known as the Destructive Green Pea Louse. In certain seasons we find on the tops of the peas a few large green winged females, with darker head and thorax. This generally occurs in late June or July. These winged females have flown from clovers, etc., and deposit living young on the peas—small green lice which rapidly grow into green wingless females which are viviparous. These wander about and after a few days commence to produce living young. Numerous generations of wingless females and now and then winged forms continue to appear on the peas right into the autumn, when a winged brood is produced which fly off to clovers, etc., and there give rise to



oviparous (egg-laying) females, which are wingless. Later, on the peas, a brood of winged males appears, which also fly off to the clovers, etc., and fertilise the egg-laying females. The latter deposit eggs which remain on the clovers till the spring, when they hatch and the young give rise to the queen aphids which produce many young asexually (without being fertilised). These continue breeding until June when winged females appear and fly off to peas and beans. Red clover is particularly attacked by this species. These insects also live on everlasting peas (*Lathyrus*, sp.) in gardens and hedgerows and on these the sexual broods also occur. The Green Pea Aphides when mature are very timid and readily fall if the bine is shaken. The insects smother the tender tips of the peas and kill them; they also attack the flowers and even the young pods in bad attacks; the latter become curled and stunted.

*Treatment.*—When a bad attack is taking place on staked peas much good has been done by shaking the insects off on to tarred boards; a feather brush has been used for this purpose by growers with much benefit, but it cannot be done with the dwarf varieties. Either spraying with soft soap and quassia or dusting with nicotine powder will also soon control this pest, the tender top growths being specially aimed at. Shaking off on to the ground and trampling the plant lice in is, however, usually sufficient.

**The Black Fly** (*Aphis rumicis*, Fabr.).—This aphid is in many years very harmful to broad beans and it now and then, in bad "blight" years, infests runner and French beans: wax-pod beans are also attacked. Unless it is dealt with at once, complete loss of crop may be the result. This species may be found on a great variety of other plants. It is frequent on the fronds of asparagus; it infests the tips of onions and may destroy the leaves; and it is also harmful to spinach and beet. It occurs in masses on docks, poppies, etc.; in some years it invades mangolds. It also winters on *Euonymus*, both wild and cultivated. It is especially beans that are attacked, notably broad beans.

The adult wingless female is black and dull, with paler legs and antennæ with dark markings; the young are deep green and the nymphæ have many white mealy patches. The winged female appears black, but the body is really deep green with black bars; the cornicles are black and the legs have pale areas.

The winged females settle on the tops of the broad beans just when they come into flower and produce living young. These soon grow into black wingless viviparous aphides which go on

reproducing until the whole of the tops of the shoots, leaves and stalks become smothered with them. The insects secrete much honey dew, which falls on to the leaves and blossoms. They increase in certain years so rapidly that they spread downwards and get on to the young pods and ruin them. The honey dew that falls down also does harm, first specking the leaves with brown spots, and the whole plant may die. In the summer a winged brood appears on the beans, etc., and these fly to other plants. Many go to mangolds, spinach and wild plants, and later in the autumn many to the wild and cultivated *Euonymus* and docks. On the *Euonymus* and docks sexual aphides occur and the oviparous females deposit their eggs. Many also live through the winter as adults on the everlasting *Euonymus* in gardens. The young coming from eggs on the docks and *Euonymus* develop several broods there in spring and then fly off to beans, poppies, etc., and so start the summer attack.

*Treatment.*—As this “blight” usually appears on a few broad beans here and there, and as from these primary colonies the blight spreads to the other beans, it is advisable to pinch off and crush all the “struck” tops. There is no doubt that ants spread this insect; the ants swarm over the colonies of black fly and one can watch them carrying females away to the tops of other beans. As the winged migrants from *Euonymus*, docks, poppies, etc., always settle on the tender tops, it is advisable to pinch off all the tops at the same time. Some growers prefer spraying; if this is done the spray should contain 6 oz. of nicotine to 100 gal. of soft soap wash. Other growers have used quassia and soft soap and reported success.

**The French Bean Root Aphid** (*Geonica phaseoli*, Passerini).—This subterranean plant louse is often very common on the roots of French beans and wax-pods, and also occurs on scarlet runners and occasionally on potatoes.

The wingless female lives entirely underground on the roots, it is more or less globular in form and of a bright yellowish-buff colour to almost white, and lightly covered with meal; the antennæ are very short. In the summer a winged brood now and then occurs. The winged females appear to place their young on the soil.

Beans that have been attacked can be distinguished by the plants flagging, especially in hot weather, and by their pale sickly hue.

*Treatment.*—When French beans, etc., are seen to be turning prematurely yellow and wilting it is well to pull up one or two and examine the roots and soil; if aphides are present they can soon be detected. Nothing can be done at that time that would





FIG. 1.—The Green Peach Aphid (*Myzus persicae*).  
Alate viviparous female.

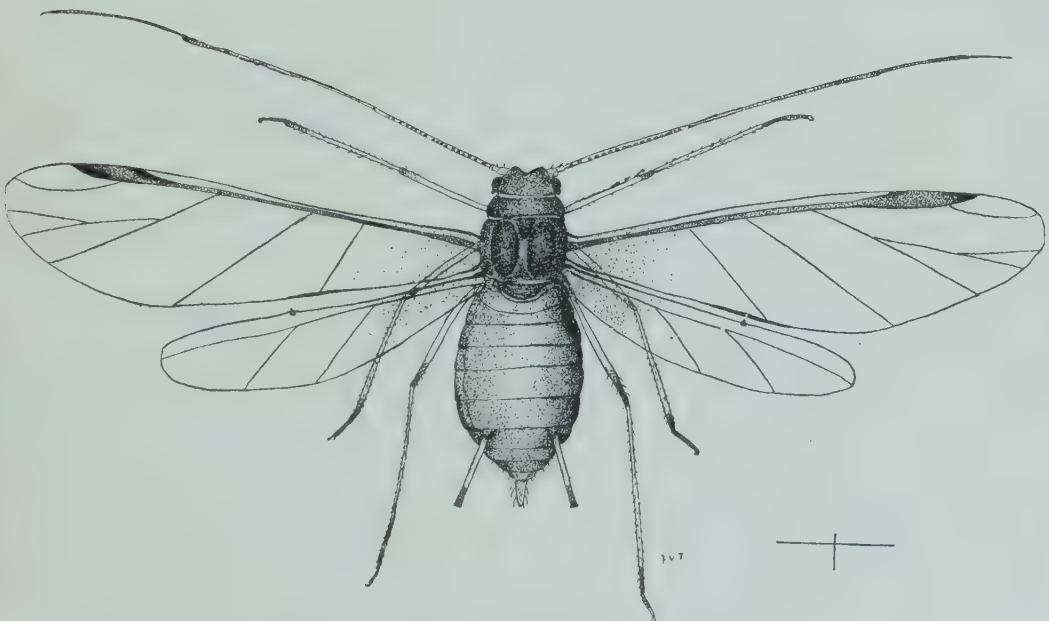


FIG. 2.—The Potato and Rose Aphid.  
(*Macrosiphum solanifolii*).



FIG. 3. Carrot split by *Anuraphis tulipae*.





FIG. 4.—*Anuraphis tulipae*.  
Apterous viviparous female.



FIG. 5.—*Brevicoryne brassicae*  
Apterous females.



FIG. 6.—*Brevicoryne brassicae*  
Alate females (Blakey).

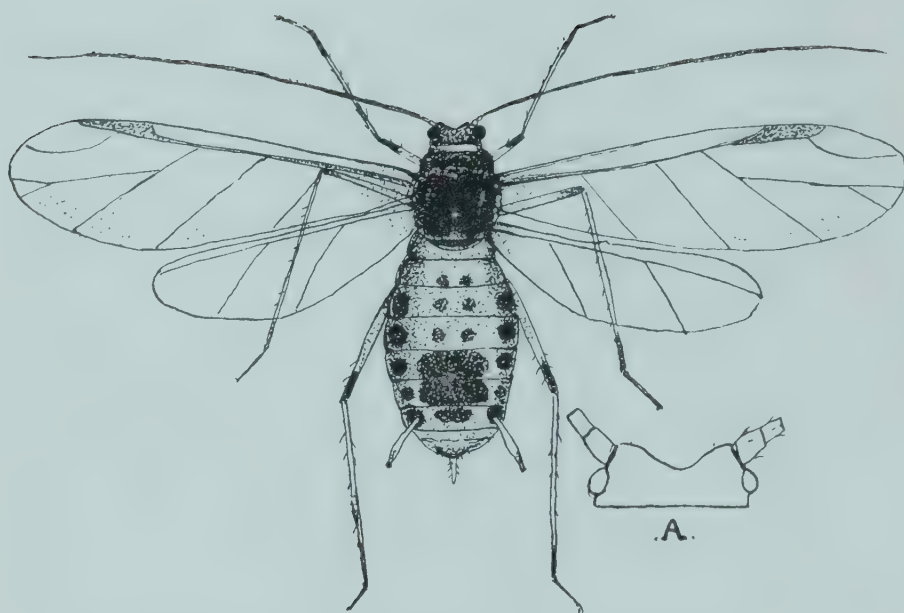


FIG. 7.—The Ribes and Lettuce Aphid. *Amphorophora lactucae*.  
Alate female.  
A. Head.

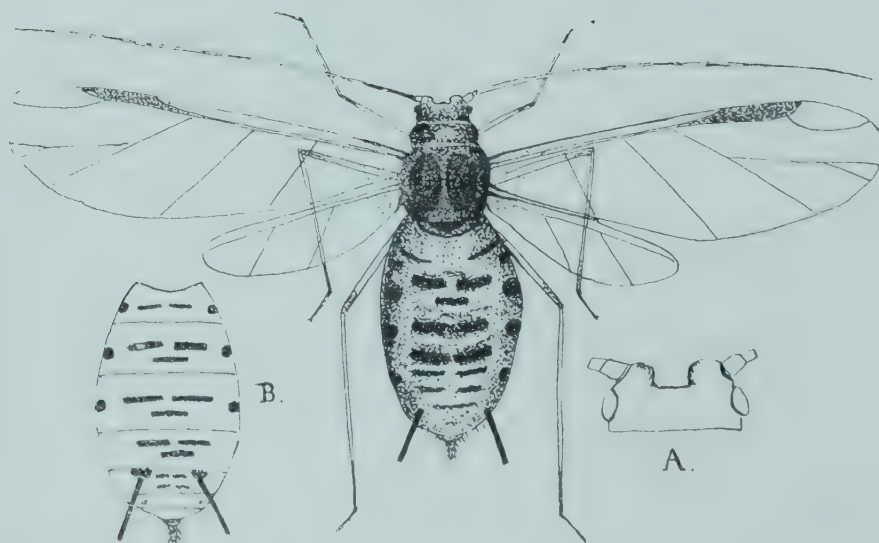


FIG. 8 —*Myzus lactucae*, or the Allied Ribes and Lettuce Aphid on Lettuce.  
A. Head. B. On Ribes.



pay, but as soon as the beans have been gathered, the haulm should be pulled and burnt on the beds and the land dressed with naphthalene at 2 cwt. to the acre and dug in so as to prevent the winged aphides from attacking other plants.

**Potato Aphides.**—Four species of plant lice are found feeding on potato foliage, namely (1) the Green Potato and Rose Aphid (*Macrosiphum solanifolii*, Ashmead); (2) the Allied Potato Aphid (*Myzus pseudosolani*, Theobald); (3) the Green Peach Aphid (*Myzus persicæ*, Sulzer); and (4) the Small Potato Aphis (*Aphis solanina*, Passerini); and occasionally the Black Fly (*Aphis rumicis*, Fabricius).

The importance of these plant lice is not only that by their puncturing they damage the leaves, which in wet weather soon rot, but they carry the virus diseases of potatoes. This appears to have been proved in America and to some extent in Britain.

(1) *The Green and Pink Potato and Rose Aphid* is the largest aphid found on potatoes.

The wingless females are green or rarely pink, with long cylindrical green cornicles and long green pointed tail. The winged females are green or pink with darker head or thorax, long green cornicles, dusky at the tips, and long green tail.

The sexual forms occur on the rose and a few on potatoes, and eggs are laid there. In summer winged broods appear on roses and other plants, derived from the wingless females that hatched from the winter eggs, and fly to the potatoes and join others that have matured from the eggs laid on the potatoes at or after the time of lifting. This aphid occurs on plants under glass all the year, specially on tulips: out of doors it occurs on roses, beans, sow thistles, and many other plants. It never seems to be a serious pest on roses, but on potatoes and tulips may do much harm.

(2) *The Allied Green Potato Aphid.*

This aphid is somewhat similar in the wingless stage to (1), but the tail is shorter and the head is a different shape. It is green, yellowish-green or deep green, with rusty patches behind in some specimens; the green antennæ have dark bands and the green cornicles are cylindrical and have dusky tips. The winged female is green with dark transverse bars and lateral spots on the abdomen, dark head and thorax.

It is widely distributed over Britain and often occurs in great numbers. This insect attacks sprouting seed potatoes. When this occurs on seed stored in out-houses, etc., it flourishes and does much harm by killing the sprouts. If this seed is planted the aphides die but the seed produces a very much reduced crop. It also occurs out of doors.

(3) *The Green Peach Aphid* is a cosmopolitan insect and feeds in great numbers on potatoes. It is found on almost all plants except the conifers and broad-leaved trees.

It can at once be recognised by the fact that the cornicles of the wingless aphids are slightly swollen, and this is also generally the case in the winged forms; in the spring brood they may be cylindrical, but they are dark and not green. The wingless female is green, yellow or pale brownish-pink; cornicles the same colour as the body, dusky at the tips and slightly swollen in the middle. The winged female is green with dark head and thorax, two dark bars on the front, and a large dark patch behind, and behind that dark bars.

This insect lives almost all the year round and may be found breeding at all times under glass and indoors. It is very important as it attacks the sprouting potato seed.

(4) *The Small Potato Aphis* occurs under the leaves, but does not seem to do much harm to the plants directly.

The wingless females vary from green to dull brownish-green, but a few are almost yellow and some deep green. The much shorter antennæ and cornicles and its smaller size at once separate it from the other potato species.

*Treatment.*—Potato aphides may be killed by spraying with nicotine and soft soap, or quassia and soft soap, but dry spraying with nicotine seems best. It is only in bad attacks, however, that this is necessary. Seed potatoes certainly want attending to when aphides are seen on them. They are best put in closed boxes and fumigated with tobacco shreds, or if few in number may be dipped in soft soap and nicotine solution. This is very important as such attacked seed, if untreated, invariably produces poor plants and few tubers.

**Aphides attacking Carrots and Parsnips.**—Carrots are often attacked below ground by an aphid known as *Anuraphis tulipæ*, Boyer. The damage is done to the roots, the insects feeding on them and causing them to split. This cracking of course is often produced by excessive wet weather, but if this is the cause then the aphides are not seen.

The wingless ground form gives rise to winged females and males which come above ground at any time between September and December. The winged males appear in November and December. It also attacks bulbs of lilies, tulips, etc.

The subterranean wingless females are pale, covered with meal, and globular in form; there is much variation in colour, some being pale fawn to kid glove white, dull olive-brown, others olive-green to pale pink, with the sides and the thoracic segments often dusky. The dusky lateral marks may continue along all the segments; the last two segments are darkened; the cornicles are short and dark; the antennæ are shorter than the body. The winged female has a shiny brown to black head and thorax, with two pale bands between. The basal half





FIG. 9.—Gall of *Pemphigus bursarius* on Poplar.



FIG. 10.—*Pemphigus bursarius* on Lettuce Roots.



FIG. 11.—Winged Female of *Pemphigus bursarius* from Lettuce.





of the abdomen is pale ochreous to fawn, dull yellow to green, some tinged with pink; the remainder is black above; there are large black spots at the sides. The cornicles are rather short, black and cylindrical; and the legs are ochreous, with dark bands.

*Willow Aphides* (*Carariella capreae*, Fbr., and *C. pastinaceae*, Sch.) also attack carrots and parsnips. Both these are found in summer on the leaves, but especially the flower heads of carrots and parsnips, and in some years do harm to the seed crop, the insects densely clustering on the flower heads.

Both are common on willow and osier leaves in late spring and summer, and about July and on into the beginning of August they become winged, when they migrate and settle on various wild and cultivated *Umbelliferae*, where they flourish until the autumn. At the latter period winged forms appear and fly back to the willow, where the egg-laying females deposit their eggs. The forms on the *Umbelliferae* may give rise to a winged generation, and these pass to other *Umbelliferae* in summer, so that the cultivated carrots and parsnips may be infected from the related wild plants as well as direct from the willows.

*Treatment*.—Beds where carrots or parsnips have been attacked by the root aphid should be treated with naphthalene and at once dug in so as to kill the aphides shaken off in pulling. The foliage and seed heads when attacked may be sprayed with any well-known aphicide; this is especially important as the aphids may much reduce the seed crop.

**Aphides Attacking Brassicæ.**—*The Mealy Cabbage Aphid* (*Brevicoryne brassicae*, Linn.).—No more objectionable sight can be seen than winter greens badly infested with aphids. The whole plant now and then becomes a sticky mass of mealy aphides, honey dew and excreta, and to make it more repulsive still there may be found crawling about amongst them the fat leech-like larvæ of the Hover Flies, predaceous insects trying to restore the balance of nature. Such attacked plants are ruined for market. In 1904-1905 this aphid was very destructive in Kent and Essex. In the Dartford district alone hundreds of acres were attacked and thousands of pounds lost. Again in 1911 it occurred in vast swarms, causing much loss in Dorset, Cheshire, Derbyshire and again appeared in countless numbers in Essex. In 1919 it was almost epidemic until November. In 1921 and 1922 it was exceedingly destructive and contributed materially to the shortage of winter greens. All manner of *Brassicæ* are attacked, as well as swedes and turnips, charlock, shepherd's purse, sea kale, etc.

The Mealy Cabbage Aphid is noticeable in May, when a few are found here and there on cultivated and wild *Brassicæ*. By

June they are more noticeable, there appearing on the leaves small pallid blister-like areas beneath which the insects shelter; later these patches become almost white. From July onwards, if the weather is propitious for the aphides, these gradually increase and smother both the upper and under sides of the leaves and stalks, until, as stated by Buckton, "Weight for weight there is more animal than vegetable substance present." All the worst attacks have been in the autumn and winter; the summer attack even if severe dies out or does not persist in such virulent form as the autumnal. Although all cultivated *Brassicæ* are attacked perhaps Brussels sprouts suffer most of all and cauliflowers least.

The wingless viviparous female is of a rather elongated oval shape, of a dull greenish-grey hue with two series of eight black spots on each side of the back; the legs, cornicles, eyes and the tips of the antennæ are deep brown. The body is covered with a white meal which quite hides the coloration. These females produce many living young, which are shiny green, but after their first moult the mealiness appears. From August onwards appear females, which have a dark head and thorax, and a dull green abdomen, with a row of seven dark patches in the centre and a row of four black spots on each side. These may unite to form continuous dark bands. The antennæ and the rather short cornicles are dark. The egg-laying females are wingless, pale green or greenish-yellow, with a row of black spots along each side of the abdomen and a double row of five dark patches along the centre.

The sexual forms appear in autumn and onwards into the winter. Some eggs are laid on and under the leaves, but mainly on the stalks. In swedes they are noticed to be mostly on the crown. One may find the eggs, viviparous forms and sexual forms all mixed up together. The leaves in November are sometimes blackened with the eggs. The eggs hatch in April and the young lice become stem mothers, which settle under the leaf and produce living young which surround them, forming small compact colonies.

*Natural Enemies.*—This species is particularly preyed upon by parasitic and predaceous enemies. Hover Fly or Syrphid larvæ feed ravenously on the masses of insects. Ladybirds, both adults and larvæ, do so to some extent. Many hymenopterous parasites attack them in the autumn.\*

*Treatment.*—All old cabbage leaves and stumps should be burnt, thus killing thousands of the eggs and over-wintering insects. All cruciferous weeds should be destroyed near the beds or fields, as many eggs are laid on them and many living aphides

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\* For an account of such predaceous insects see *Beneficial Insects* (with two coloured plates), price 4d., from the Ministry).



may even over-winter there and be ready to infest the Brassicæ in spring and early summer. This especially applies to charlock and shepherd's purse. The disease often starts in the seed beds and if this is seen it pays to spray the plants and so prevent the insects from being taken to the fields. The most successful spray is nicotine and soap. If spraying is not done all seedlings showing signs of aphid should be discarded and destroyed. It is doubtful if spraying in the field would pay. When waste pepper was cheap it was used, mixed with road dust, for dusting Brussels sprouts, and it might even prove possible to spray sprouts, when seen to be attacked, with strong soft soap and water, if the market price at the time would allow. The destruction as soon as possible of cabbage stumps and old leaves is a most essential matter, especially if the plants have been badly attacked. The green peach aphid also attacks Brassicæ.

**Lettuce Aphides.**—Four kinds of plant lice feed on lettuce and endives, and in some seasons spoil them for market, as the insects breed rapidly in the hearts, making them obnoxious, and cannot easily be cleaned out even by much washing. The four species are (1) the Ribes and Lettuce Aphid (*Amphorophora lactucæ*), (2) the Allied Ribes and Lettuce Aphid (*Myzus lactucæ*), (3) the Dark Sow-thistle Aphid (*Macrosiphum sonchi*), and (4) the Poplar Gall and Lettuce Root Aphid (*Pemphigus bursarius*). The fourth attacks the roots.

(1) *The Ribes and Lettuce Amphorophora* is the worst of these plant lice. It is a common currant and gooseberry aphid, which in some years swarms on lettuces.

The wingless female on lettuces is shiny green to yellowish-green, and the green antennæ have dark bands. The tail and cornicles are green, the latter somewhat swollen; the yellowish-green legs have dark bands. The winged female on lettuces has deep brown to black shiny head and thorax, with a yellowish-green band in front of the latter. The abdomen is yellowish-green, with an irregular dark broken area on the posterior half, two pairs of small black dots in front and three large and one small dark lateral spot and a large patch at the base of each cornicle. The tail is pale yellow. The cornicles are yellow, swollen, and dusky at the tips. The legs are yellowish-green with dark bands. The winged female on *Ribes* is very similar, but the dark abdominal area is not quite so large and there are traces on the first two to four segments of sub-median dark spots. The wingless forms are very similar also but of a somewhat deeper colour.

This insect winters on *Ribes* in the egg stage, and breeds rapidly on them in some years, doing much damage. In late May and on to July the aphides become winged and fly off to the summer food plants, some settling on lettuces, others on sow-thistles and other plants. Winged broods are produced and fly

off and attack other lettuces, etc. Mid and late crops suffer most.

(2) *The Allied Ribes and Lettuce Aphid* also infests lettuce in a similar manner to (1) and also comes from currants and gooseberries.

It can at once be distinguished from the former by the cylindrical dusky cornicles in the winged female. The wingless female is yellowish-green to light green, some pinkish, and the abdomen has dark lateral spots. The cornicles are yellowish, dusky at the tips, and cylindrical. The tail is yellow. The winged female on *Ribes* has a shiny black thorax, with a green line each side and a pale band in front; the head is green; the abdomen shiny green to yellowish-green, and there are dark basal patches, etc., on the body. The cornicles are long, thin, cylindrical, black, and paler at the tips. The wingless female is much like that on the lettuce.

Like the former species it winters on the *Ribes* and leaves them in late May and June and flies off to the lettuces, sow-thistles, etc. There the winged females produce young and reproduction goes on all the summer. In the autumn winged return migrants fly from the lettuces to the *Ribes* and there give rise to the oviparous females; having copulated with the winged males, the former lay their few eggs on the *Ribes*. In wet weather the damage done by these plant lice to lettuces, etc., is intensified and the interior of the lettuce becomes not only disfigured by the insects, but also rots.

(3) *The Dark Sow-thistle Aphid* also does some damage to the seed crop. It lives on the Annual Sow-thistle (*Sonchus oleraceæ*) and other plants.

This aphid is a rich chesnut-brown to deep shiny red; the cornicles are long and black and the tail yellow.

*Control*.—The only possible control of the two first species consists in destroying the aphides when on *Ribes* in winter or spring by spraying with carbolineum emulsions to destroy the ova or with nicotine soap washes to kill the hatched insects. All sow-thistles, *Crepis*, *Lapsana* and other weeds should be kept down, but when lettuces are once attacked it would not pay to adopt any curative treatment, even if such were possible, for the insects shelter in the hearts where they cannot be touched.

(4) *The Poplar Gall and Lettuce Root Aphid*.—One frequently finds on pulling lettuces, especially late ones, that the roots are covered with white flocculent wool. This is due to the above-mentioned aphid which comes from the poplar. In some seasons so many of these subterranean aphides occur that they kill the late autumn and early spring lettuces. The insect winters in two ways (a) on the roots of lettuce and other similar plants.



and (b) in the egg stage on poplars, where the stem mothers form very marked galls on the leaf stalks. One of these galls is formed by a single stem mother aphid, and in it she produces her young. The gall later bursts and the winged aphides fly away, usually in July. These winged forms place their young on the soil near lettuce and other roots. They are found in colonies in the soil, often in cavities thickly massed together, with white wool near and around, as well as on, the roots of lettuce, sow-thistle, etc. They increase rapidly on the lettuce roots and may continue to do so all the winter. At the same time winged females may arise from them in late September, October and November, and these fly off to the poplars where they produce sexual forms and eggs are laid on the buds. On the bursting of the poplar galls, the cycle is repeated. It becomes first noticeable on lettuce roots in August and gradually increases until February, when it dies down and none are noticed from May to July.

*Treatment.*—Obviously we cannot stop infection of the soil, as it is impossible to deal with the insect on poplar trees, but where summer lettuces have been attacked, it is just as well to destroy the insect in the soil, especially if lettuces for late winter and early spring use are to be planted there. The common practice of leaving lettuces killed by frost or rotting from wet in the soil should be avoided. As the aphid will not only live on lettuces but on sow-thistles, etc., if these occur, and any white wool is found on the roots they should be burnt and the ground dressed with naphthalene and dug in, or it should be very deeply cultivated.

**The Artichoke Root Lice** (*Trama troglodytes*, Heyden).—Jerusalem Artichokes are very often attacked by these pale-coloured subterranean aphides. Although they do not in the least affect the growth of the stem and leaves of such strong plants, they, nevertheless, by means of constant puncturing of the tubers, cause many of these to decay before they are lifted and many more afterwards. These aphides frequently occur in masses in artichoke beds and are always attended by ants, which take from them the sweet honey-dew they exude.

These pale fat plant lice can at once be distinguished by their long hind legs, the so-called second tarsal segment being very long, and by the curious way they lift up their hind legs if touched or frightened. The wingless females vary in colour from pale yellowish-white to pearly-white or dull yellowish-green, often semi-transparent. The antennæ are brown and less than half the length of the body. The winged female has a broad head and thorax and a small body; the antennæ are short, not much longer than the head and thorax, and the cornicles are slightly raised.

These aphides occur in the soil at all times of the year. The wingless forms feed on the roots of many other plants, including sow-thistles and thistles, etc., and are frequently found with ants in their nests.

*Treatment.*—After artichokes have been lifted the beds should be dressed with some soil insecticide, as the insects go on multiplying in the ground.

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## FRUIT PACKING AND MARKETING IN CALIFORNIA.

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THE State of California, being on the western seaboard of the United States, has a climate tempered by the warm seas of the Pacific Ocean; the summers are hot and the winters almost free from frost, so that a large range of varieties of fruit and nuts can be cultivated out of doors as, for example, apples, apricots, cherries, figs, grapes, nectarines, peaches, pears, persimmons, plums, prunes, quinces, oranges, lemons, strawberries, blackberries, loganberries, raspberries, gooseberries, currants, olives, almonds, pecans and walnuts. It could not, of course, be claimed that all grow to perfection. Apples, oranges and pears are seen growing in the same locality, and sometimes in the same field, yet this arrangement must be due partly to the ambitions of the cultivator, for no one set of conditions can accommodate well all these kinds of fruits. Placed in sheltered positions between the Coast Range and the Cascade Range of mountains are numerous wide flat valleys, such as the Sacramento Valley and the Imperial Valley, where the soil is extremely fertile if only sufficient soil moisture can be provided to keep the plants growing. In most localities the heat of the summer sun is too intense and the normal rainfall is insufficient to maintain good plant growth. Irrigation is therefore almost universally practised, the water being taken from wells, rivers or even from the snow water from the glacier and high mountains of the Cascade. Under these conditions, California has been able to develop a fruit-growing industry of exceptionally large dimensions, though owing to the extreme length of the State the several fruit regions are far apart, that of the Imperial Valley in the south being fully 750 miles from the Shasta area in the



north—as far as Kent is from Inverness. Yet, as will appear later, the grading, packing and marketing of the deciduous fruits from all these widely separated areas is all done under the influence of one large growers' organisation. Each separate valley where fruit can be grown has its own peculiarities which have been exploited for the production of some special crop. There are thus a number of isolated areas important for the production of one, or at most two, crops.

With a helpful climate and fertile soils situated in sheltered valleys, the production of fruit even in large quantities was not a difficult matter: by no means was it as serious as the problem of marketing, and the difficulties of the earlier growers centred almost entirely around marketing. The difficulties were very great, on account of the vast distances to be covered before the fruits reached the markets. Thus, almost at the commencement, growers were drawn together to seek for an organisation whereby they might collectively overcome the obstacles of proper packing, transportation and marketing, which appeared to be too big for individual effort. Men came together, not from over the wide field of the whole State, but just a few here and there engaged in a similar industry and generally situated in the same locality; these banded together to work for the common good and formed small Growers' Associations to put the results of their deliberations into practice.

One of the earliest of these associations to be formed was the Sacramento River Association. It is located in one of the finest parts of the State for fruit growing, with a climate particularly favourable to the growing of deciduous fruits, and especially the William Bon Chrétien, or Bartlett, pear.

This association at present includes about sixty growers and shippers, some of whom have been identified with the organisation since it was formed twenty years ago.

The association now operates three sheds for receiving fruit for assembling for eastern markets—the Sacramento Docks, Walnut Grove and Hood. Generally the members are engaged in farming large acreages of fruit and are able to establish their own packing sheds and to carry out the grading and packing of the fruit on the farms. At Hood, however, the association in 1923 found it necessary to erect a community packing house where the fruit could be graded, packed and sent out under uniform labels. This packing house, which is two storeys in height, is a fine type of construction, equipped with modern labour-saving facilities for the efficient handling of box

fruits, which consist mainly of William (syn. Bartlett) pears. The pears come to the house early in July, and are practically all harvested by 15th August. In the packing house, the pears are run through a mechanical sizer, whereby the bulk is sorted, either by weight or width, into different sizes. Girls pack direct from the bin, wrapping each pear in paper before placing it in the standard pear box, carrying out that operation in much the same manner as has been described for apples,\* though perhaps a greater number of styles of pear packs are admitted to be commercial than are recognised for the apple. After leaving the packer, the pear boxes are fastened, labelled and checked before being assembled for delivery to the market.

**Plums.**—Plums, chiefly of the varieties Tragedy, Santa Rosa, and Formosa, rank next in importance. They also are well packed, though for grading and sizing no mechanical devices yet tried have proved successful. The tree-gathered plums are brought into the packing house and emptied on to packing tables, which are wooden frameworks usually fitted with burlap or canvas bottoms or with wooden bottoms padded with various materials. Any type of table that would prevent bruising appeared to give satisfaction. Here, girls sort and grade the plums and pack them, two layers deep, into square chip baskets (without handles) each holding 5 lb. of fruit. Four of these chip baskets fit side by side into a cheap wooden crate which bears the labels, name of variety and net weight. The standard market package of plums from California is then a 20 lb. crate, but retailers have four separate baskets in each crate, and—I am told—are able to sell most of this kind of fruit by the unbroken basket.

**Cherries.**—The sweet cherry (Knight Early Black, Burbank, Black Eagle, Black Tartarian, Bing, etc.), is picked when nearly mature—that is, when practically all the changing of starch to sugar has ceased, and the fruit has attained the colour characteristic for the variety—into galvanized iron water pails in which they are delivered to the packing houses, where they are emptied into the packing trays, the boys being careful to pour the cherries out gently. Here they are graded for colour and size and packed into “Cherry Boxes” holding 10 lb. or “Cherry Lug” of 20 lb. The empty box, turned with the face down, is placed so as to incline towards the packer at an angle of about thirty degrees. The girls then select cherries

\* “Packing Apples in the Okanagan Valley, British Columbia”: *This Journal*, Feb., 1925, p. 1034.





FIG. 1.—The standard market package of plums, containing 4 square chip baskets each holding 5 lb. of plums all of the same size and colour.



FIG. 2.—The cherry box holds 10 lb. of fruit. The two top layers only are packed in definite order.





of the same size and colour and place these on their sides in proper alignment and with the stems towards the paper. Holding the fruit in position with one hand and selecting fruits with the other, the packer arranges the cherries in line across the box. Each successive row is placed in direct alignment (straight pack) with the preceding one. Having packed the first layer in this manner, the second layer is packed by placing cherries in the spaces formed by the first layer. When the second layer has been completed the box is placed on the level and filled with cherries without regard to definite alignment. The bottom of the pack is neatly finished off so that the corners and sides of the box are well filled and no fruits or stems extend over the edges of the box. The whole is covered with paper and the box is ready to leave the packing bench to be fastened, labelled and dispatched. At times, the very best fruits are packed in cartons, four of which exactly fit into the tin-framed box.

The Sacramento River Association operates over a comparatively small area. In other districts, similar associations operating in much the same way have been formed, so that in the whole State there must be nearly one hundred of these local associations, all working under standard by-laws, with such variations as may be necessary to suit local conditions; and all are said to be incorporated under the co-operative laws of the State of California, as non-stock, non-profit associations.

Each local association elects its own Board of usually five Directors, with a President, Vice-President and Secretary, and appoints its own manager and packing-house employees.

The earliest formed societies had, no doubt, to make their own arrangements with the Railway Companies for the dispatch of the fruits to the markets and for their sale in the markets, but, by 1900, the deciduous fruit-growers in California had come to the conclusion that if the fruit industry was to survive, the system of marketing must be greatly improved and, in fact, the marketing of the whole produce centralised as far as possible in one exchange. The many local associations agreed to limit their functions to assembling, grading, packing and loading the fruit, and they agreed to co-operate in setting up a selling organisation—the California Fruit Exchange—to sell the produce for all societies. In 1907, this Exchange was reorganised on a capital stock basis, with a permissible capitalisation of \$100,000 divided into one thousand shares of \$100 par value. Provision was made for the distribution of

these shares amongst bona fide fruit-growers, though no man could hold more than two shares.

The associations have a combined membership of over 6,500 growers, so that the quantity of deciduous fruits sold for the growers by this one organisation is very large, as instanced by the following figures which have been given to the writer by the manager of the California Fruit Exchange.

<i>Year.</i>	<i>No. of Cars.</i>	<i>Gross Sales.</i>	<i>Net Returns.</i>
1920	5,596	\$13,473,801	\$8,666,178
1921	6,281	\$12,680,295	\$6,952,475
1922	8,560	\$12,935,832	\$8,280,069
1923	10,935	\$17,173,124	\$10,629,060

To deal efficiently with such a volume of business, quite a large staff is required at the central organisation, as, for example, a General Manager's Department, Sales Department, Accounting Department, Traffic Department, Claims Department, Supply Department, Standardisation Department and Lumber Department. (This Exchange is distinct from the California Fruit Growers' Exchange, which is a similar but larger organisation trading in citrus fruits.) Practically no fruit is sold f.o.b. in the producing centre, and in that respect their policy differs from that of all other exchanges previously described,\* though the same method is adopted by the California Fruit Growers Exchange in selling citrus fruits.

By contract with the California Fruit Growers' Exchange, the members of the California Fruit Exchange now utilise the marketing machinery which has been set up by the former for selling citrus fruits. The Exchange is represented by salaried agents in some eighty cities and towns, and in this way secures a wide distribution and fewer glutted markets. The price at which the fruit is to be sold in the towns is fixed by the sales department of the central organisation, and the salaried representatives in the towns attempt to sell in car-loads lots to wholesale merchants and others, or, failing that, they send the fruit for sale in the auction rooms, where they are able to attend the auctions and watch the prices. By having their own representatives in the markets the Central Exchange claim to be able to regulate their cars to the several markets in a more orderly manner ; to hold car-loads back in order to catch better markets ; or to reconsign loaded cars in transit to markets found to be glutted, to others less well supplied. It is a system which is

\* Apple Packing in Nova Scotia, this *Journal*, Dec., 1924, p. 856 ;  
 " Packing Apples in British Columbia," Feb., 1925, p. 1034.



said to have worked splendidly for the citrus fruits, and seems to be giving satisfaction to the deciduous fruit growers. It is important to bear in mind that these salaried agents operate in the markets as brokers and not as distributors, *i.e.*, they sell in lots of a car-load which may be anything between 700 and 800 boxes. Their business is done with the wholesale merchants, and, so far as the writer is aware, no selling to retailers has ever been attempted, nor did the Exchange seem to think that such a course would prove desirable or even economical.

All grower members of the Fruit Exchange are charged 7 per cent. for marketing the fruit, which is said to be the usual rate charged by commercial companies engaged in the same line of business. The Exchange does business at cost, and the difference between the actual cost of doing business in any one season and the 7 per cent. charged goes into a "Withholdings Account." This "Withholdings Account" constitutes the operating fund of the organisation. At no time in the history of the Exchange has its cost of doing business been more than 3 per cent., and the average cost over a period of the last six years has been 2.72 per cent. As a usual thing, therefore, growers operating through the California Fruit Exchange have their business handled for about 3 per cent., and the remaining 4 per cent. is placed in the withholdings or operating fund, of which one-half is returned during the year immediately following the crop season and the other half at the expiration of five years. Thus, any grower who has been with the California Fruit Exchange for a period of five years receives back each year about 4 of the 7 per cent. deducted on the gross delivered selling price. This "Withholdings Repayable Account," now totalling \$1,660,000, is seldom understood properly by the growers, but it seems a perfectly simple and sound plan for providing the working capital, and is preferable to borrowing from the Bank or to the issue of stock shares.

Year by year the Exchange seems to have increased its volume of business until at the present time it claims to be handling fully 45 per cent. of the total Californian production of deciduous fruits. Growers not making use of the Exchange have to make use of the selling organisations and packing stations of independent merchants, of which there are a large number at each fruit shipping point. The growers are, in fact, not tied to the Exchanges by contracts longer than twelve months, and in practice growers at times leave the Exchanges for a while and then sign on again. This freedom of action left to growers is advantageous and much appreciated.

The Central Organisation is also responsible for the purchase and distribution of practically all the material and equipment used in harvesting the crops throughout the State. It was, in fact, compelled at one stage during the War period, to enter the lumber business to secure material for making its fruit boxes, and now owns approximately 15,000 acres of timber, including saw mills, box factory, etc., a piece of business which has proved very profitable to the Associations.

\* \* \* \* \*

## FURTHER OBSERVATIONS ON THE FOOD OF THE LITTLE OWL.

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MOST of the British resident species of raptorial birds, and particularly the owls, have been definitely classified as regards their potentiality for good or ill, but the case of the Little Owl (*Athene noctua vidalii*) is somewhat different; and as there still appears to be some doubt as to the economic status of this bird, and the question is one of considerable importance to agriculturists, a few observations from a field ornithologist may be of some value.

The subject has been dealt with by Dr. Collinge,\* of the York Museum, far more exhaustively than has been possible by the writer, who is glad to find, however, that his conclusions closely resemble those arrived at by Dr. Collinge.

A brief résumé of the British history of the species may be of interest. Since Waterton's initial essay in 1842 numbers of these birds have been liberated from time to time by various ornithologists, notably the late Lord Lilford and Mr. E. G. B. Meade-Waldo, more as ornithological experiments than as serious attempts to establish the species in this country. Before Waterton's time the little owl was not a resident breeding species, and the few examples recorded may be presumed to have been stragglers from the Continent or escapes from aviaries, private or otherwise.

From the point of view of the species itself, these experiments were a distinct success; so much so, in fact, that in many districts it is now our commonest owl. The species has multiplied abundantly and is rapidly extending its range. At

\* See "The Food and Feeding Habits of the Little Owl," by W. E. Collinge, this *Journal*, Feb., 1922, p. 1022; March, 1922, p. 1133 (including bibliography); and Nov., 1922, p. 750.



the present time it is plentiful in the Midland, Eastern and Southern Counties, and last year the writer found it quite common as far afield as South Devon.



FIG. 1.—The Little Owl (*about  $\frac{1}{2}$  nat. size*).

Generally speaking, the food of the little owl is much the same as that of the majority of British owls, but as this bird has been accused of extending its depredations to the game covert and the poultry yard, it is proposed to discuss briefly the evidence afforded by a series of observations.

As the little owl frequently hunts by day as well as at night, it must be admitted that its opportunities for harm are considerably greater than those of most owls, and, as already mentioned, it is significant that most of the complaints on this head emanate from gamekeepers and poultry farmers.

Apart from the examination of the stomachs of specimens, probably the most reliable methods of ascertaining the food of owls are:—

- (1) Inspection of the remains found in the birds' nesting holes, and
- (2) Systematic examination of the pellets cast up by the birds.

As regards method (1), out of some thirty nesting holes kept under observation at different periods, the writer has on two occasions found evidence of objectionable operations. The first item was the wing of a full grown partridge (a somewhat surprising find, and in view of the difficulties of size, weight and transport, possibly one better left out of consideration), the other being a week-old Wyandotte chick. This is a decidedly meagre result from the point of view of the prosecution, and one that would appear to show that the victims were the result of occasional lapses, rather than staple items of the owls' diet.

It must be admitted that this method has its defects, and that much more satisfactory results may be derived from dissection of the pellets. The results obtained by this latter means are extremely interesting. The tests covered a period of three years, were carried out in two counties, and concerned twelve nesting holes, all of which were visited at regular intervals during the breeding season, in districts where game and poultry are plentiful.

Below are given particulars of the contents of the pellets examined, together with the number of pellets examined at each nesting hole:—

No.	County.	No. of Visits.	Total Pellets examined.	Contents of Pellets.
1.	Kent	4	12	Bones and fur of small rodents, feathers and bones of house sparrow.
2.	„	3	15	Bones and fur of rodents, bones of small bird (species not ascertained).
3.	„	4	16	Bones and fur of rodents, fragments of shell of snail (apparently <i>H. aspersa</i> ), elytra of carabid beetles.
4.	„	3	9	Bones and fur of rodents, bones of small birds (finches).
5.	„	4	16	Bones and fur of rodents, numerous elytra of carabid beetles, wing bone of blackbird.
6.	„	3	15	Bones and fur of rodents, bones of small fish (minnow).



No.	County.	No. of Visits.	Total Pellets examined.	Contents of Pellets.
7.	Essex	3	15	Bones and fur of rodents, numerous elytra of common cockchafer ( <i>Melolontha vulgaris</i> ), leg bones of sparrows.
8.	„	4	12	Bones and fur of rodents, elytra of cockchafers, fragments of snail shells.
9.	„	3	15	Bones and fur of rodents, portions of grit, elytra of beetles.
10.	„	4	20	Bones and fur of rodents, skull of house sparrow, fragments of noctuid pupa cases, elytra of beetles.
11.	„	4	12	Bones and fur of rodents, bones of common frog, elytra of various beetles.
12.	„	4	16	Bones and fur of rodents, elytra of various beetles.

It will thus be seen that, in every nesting hole, the pellets examined contained the fur and bones of rodents, and the following is a summary of the remaining contents:—

In 8 nesting holes pellets contained wing cases of beetles.

„ 6	„	„	„	„	bones and feathers of small birds.
„ 2	„	„	„	„	fragments of snail shells.
„ 1	„	„	„	„	bones of small fish.
„ 1	„	„	„	„	bones of frog.

There would, of course, be no trace in the pellets of such soft food as earthworms and larvæ of insects.

As already mentioned, Dr. Collinge's series of tests was much more extensive and the results correspondingly more valuable, but the results tabulated above are of assistance in the task of determining the agricultural status of the little owl. Altogether, the results of investigations carried out by various ornithologists up to date may be said to show that the evidence in the bird's favour is strong.

It would be idle to deny that most of our raptores suffer occasional lapses in the matter of slaughtered domestic birds and young game, but the writer's opinion is that, so far as the owls are concerned, such instances are exceptional. It is to be hoped that the time is not far distant when the true value of our owls will be recognised generally, and it is gratifying to note that already much has been accomplished in this direction.

## MAY ON THE FARM.

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**Arable Land.**—Towards the end of May, or earlier in a dry warm season, the Turnip Fly may begin to infest turnip seedlings. Their sudden and mysterious appearance in large numbers was formerly attributed to the seed having contained the eggs; but it is now known that the beetles are about and breeding a month or two earlier in the year, feeding on cruciferous weeds such as charlock. They fly freely when the temperature of the air is in the neighbourhood of 70° F., and apparently they are attracted to the turnip crop by its scent. Possibly the protective virtue of soaking the seed in turpentine is attributable to its masking the natural odour of the crop. In favour of the practice may be mentioned the fact that soaking for about two days has no injurious effect on the growing properties of the seed but in fact slightly accelerates germination.

It is generally agreed that measures which enable the crop to reach the rough-leaf stage quickly are the best means of preventing destruction by this pest: a good tilth (*i.e.*, fine, firm, moist soil) containing a little superphosphate and nitrate of lime favours quick establishment of the plant. Rolling when the seedlings are through the ground will often assist, especially where the soil was rather dry and loose at sowing. I have also seen the beetles driven off by an application of sawdust containing paraffin. Dusting with noxious powders such as soot, basic slag, lime and sulphur has also been advocated and tried: in 1911 experiments were conducted by the East Anglian Institute and it was found that soot, sulphur and spent tan were of no remedial value; lime had a slightly beneficial effect; paraffin emulsion drove the beetles off for one day; but the application of 1 cwt. nitrate of lime per acre was attended with considerable success.

Mangold seeds and seedlings also have their insect enemies: but as these are not readily found by the farmer he rarely attributes a failure of the mangold plant to this cause. Drilling too deeply, lack of lime in the soil and the application of an excess of soluble fertilisers may account for failure, but insect attack is not uncommon. Each case of mangolds coming up unsatisfactorily or going away should be reported to the County Agricultural Organiser for investigation, with the assistance of the Provincial Advisory Officers where necessary.



The weather in May is as a rule favourable to the work of killing weeds, either by dragging them out of the ground and drying them on the surface in the case of free soils, or by drying the clods containing the weeds where the soil is of heavier texture. In the latter case, however, it may not be possible to sow until June. Under these conditions crops of deeper rooting habit and better drought resisting properties than swedes may be preferable, viz., common turnips and marrow stem kale. Both of these, as they cover the ground more quickly than swedes, may also be of advantage where quite satisfactory cleaning before sowing is impossible.

Regarding varieties of swedes, attention may again be directed to the existence of sorts which, on land infected with finger-and-toe disease, are less susceptible to injury by this pest than the ordinary varieties. Tipperary, a quick growing and heavy cropping purple-top swede, grows well out of the ground and thereby suffers less lamage than sorts in which the "root" is more deeply inserted in the soil. Two Danish strains of Bangholm, viz., No. 25 and No. 4, have been proved to possess considerable powers of resistance to the disease.\*

**May Pasture and Milk Yields.**—Ordinarily the daily yield of a cow rises for a few weeks after calving then falls gradually with the advance of lactation until she goes dry, from the 38th to the 45th week, according to the date of service. In Fig. 1 are graphically represented the average daily yields at successive stages in the lactation of 95 cows which calved between 1st May and 30th June. The information embodied in the

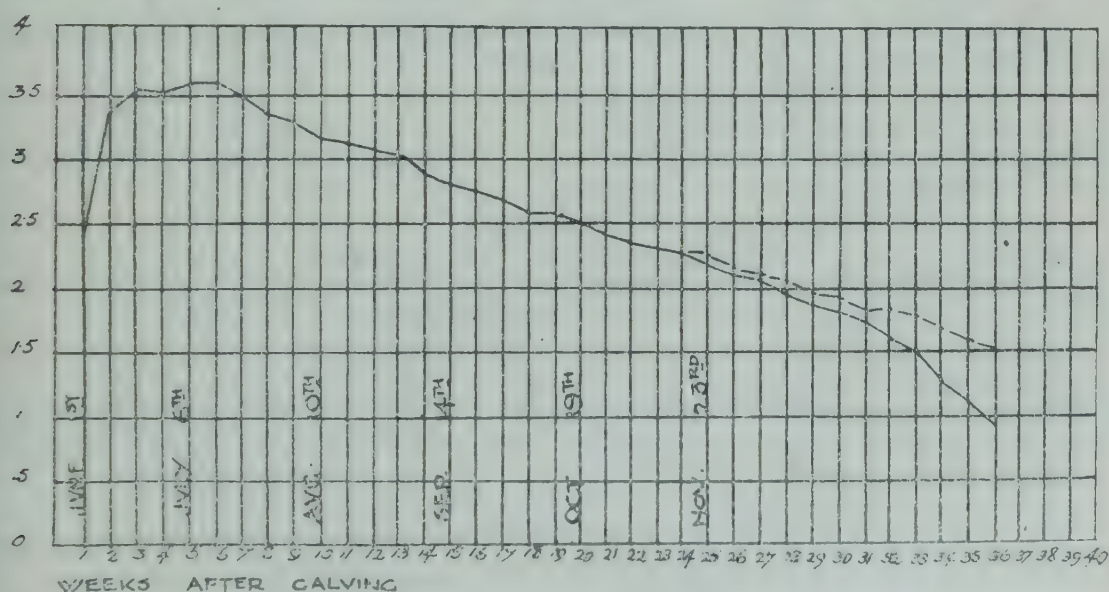


FIG. 1.—Variation in Milk Yield with advance of Lactation.

\* See "Swedes Resistant to Finger-and-Toe," this *Journal*, July, 1922, p. 362.

curve was extracted by Gavin from the records of the Terling herd and published in the *Journal of Agricultural Science*, Vol. V, page 309.

In Fig. 1 the curve branches at the 24th week: the lower line represents the yields of cows served between the 9th and 12th week after calving, the depressing effect of pregnancy being apparent as an accelerated fall in yield from about the 14th week after conception. The upper curve shows the effect of deferring service for a further eight weeks. Besides the incidence of pregnancy, however, there are other influences which modify the yield curve for individual cows—the efficiency of the milkers, the condition of the animal at calving and the nature and quantity of the ration. An autumn or winter calver on going out to pasture in May “flushes” or increases her yield by 5 per cent. to 20 per cent. according to the winter feeding and management and the quality of the pasture to which she is transferred. The effect of May pasture on the daily yield of the winter calver is indeed an important consideration: a rise of 20 per cent. suggests that the winter ration has been defective or that the cows have had insufficient water; a fall or even the absence of a rise of 1 to 2 lb. in daily yield during the month of May would appear to indicate that the pasture land required improvement or that the winter diet had been excessively rich.

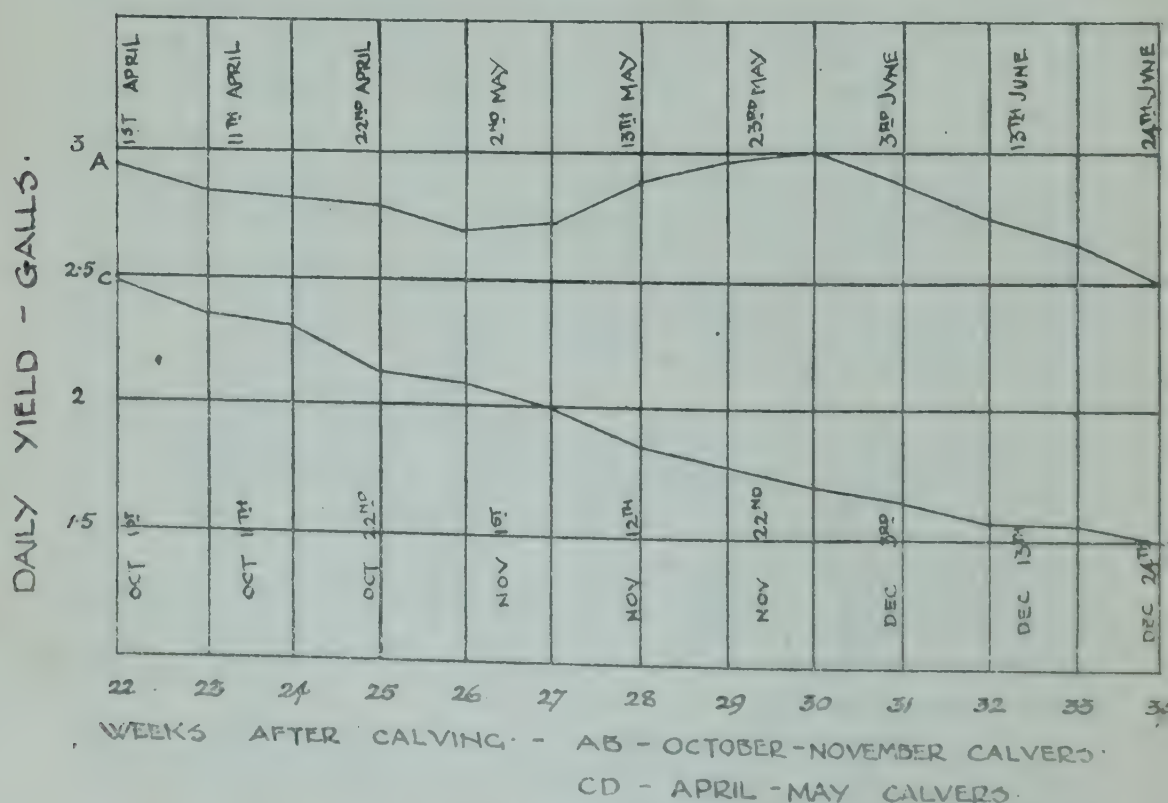


FIG. 2.—Effect of May Pasture on Milk Yield.



In Fig. 2 are represented the average daily yields in 89 lactations of cows in Mr. C. Fielding's (Matlock) herd of Lincoln Reds during the 6 years 1919-24. The upper curve, A.B., embodies the April to June part of 47 lactations, typically October-November calvers: their average yield per annum was 8,687 lb. The lower curve, C.D., embodies the autumn part of 42 lactations, typically April-May calvers with an average annual yield of 7,574 lb.

The increase in yield shown as due to pasture in the upper curve of Fig. 2, is greater than that normally associated with a change from efficient winter feeding and management to fair May grass. The curve represents, however, the yields during six years, in three of which the previous winter feeding was unavoidably unsatisfactory. During the three years 1918-20, concentrated foods were scarce and very expensive, linseed cake, for instance, being £20 or more per ton. During the next three years the herd received a properly balanced winter ration, fed slightly above the cows' requirements as measured by the accepted feeding standards. The following figures show the difference between the yields in the two series of years:—

				Years.		
				1919-21	1922-24	1919-24
No. of lactations	...	...	...	22	25	47
Average No. of weeks calved...				21.7	21.5	21.6
Average yield per annum	...			7,888 lb.	9,391 lb.	8,687 lb.
Average yield per day :						
Indoors	April	1	...	26.5 lb.	31.8 lb.	29.3 lb.
	"	8	...	25.3 "	31.1 "	28.3 "
	"	15	...	25.1 "	30.7 "	28.1 "
	"	22	...	25.9 "	29.9 "	28.0 "
	"	29	...	24.9 "	28.7 "	26.9 "
	May	6	...	26.2 "	28.3 "	27.3 "
On Pasture	May	13	...	29.6 "	28.5 "	29.0 "
	"	20	...	30.0 "	29.5 "	29.8 "
	"	27	...	29.9 "	30.4 "	30.1 "
	June	3	...	28.5 "	29.2 "	28.9 "
	"	10	...	27.1 "	27.5 "	27.4 "
	"	17	...	26.1 "	26.8 "	24.4 "
	"	24	...	24.8 "	25.0 "	24.9 "

In the above averages and curves (Fig. 2), no lactation has been included in which the cow had calved within 6 weeks previous to 1st April or 1st October: the object of this was to exclude increases due to the natural tendency to rise in yield during the first few weeks of lactation.

The effect of May pasture on the quality of milk has not been studied so thoroughly as its effect on quantity. Generally some depression in quality might be expected to accompany a considerable rise in yield on going out to grass; and, under certain

conditions, the morning's milk might be found to contain less than the accepted standard of 3 per cent. of fat: this might be the case where the night interval between the milkings exceeded 13 hours and where the majority of the cows in the herd were spring calvers.

**The Dairy Farm.**—The following particulars are typical of a fairly well-stocked Derbyshire dairy holding of 100 acres:—

	<i>Acres</i>	<i>Live Stock</i>	<i>No.</i>	<i>Labour</i>	<i>No.</i>
Pasture ...	50	Dairy Herd ...	24	Men ...	2
Meadow ...	30	Young cattle ...	16	Youth ...	1
Arable ...	20	Work horses ...	3		

On many farms a greater proportion of permanent grass is mown, and where the head of winter stock is not heavy, there is a tendency to feed excessive quantities of hay. Ration records in this county have indicated that hay fed in excess of about 17 lb. per cow per day is not well utilised. In other cases where the proportion of mown land is high, young stock are sent away to summer ley instead of being grazed at home: the money so spent on ley would in many instances produce a better return if expended on phosphatic dressings to increase the stock-carrying capacity of the home pastures.

A correspondent has raised the question of whether in the case of a small farm even 30 per cent. is not too great a part of the farm to be devoted to the comparatively low-productive hay crop. He suggests that the smallholder at any rate might with advantage keep more cows by grazing the whole of his permanent grass land and buying the hay required for the maintenance of the herd in winter. The question involved is whether tending and milking cows is more remunerative than cultivating and making the hay crop. I believe that it would often pay the small farmer to adopt the above suggestion, with the modification that wet grains should be bought to take the place of part of the hay that would otherwise be grown or purchased. Instead of growing hay sufficient to provide a daily allowance of 16 lb., the winter ration might contain 14 lb. of wet grains and only 8 lb. of hay, either home-grown or bought.

If the same policy were adopted generally and on larger holdings, hay growing would soon be more profitable than milk production and wet grains would rise to prohibitive prices. Under present condition, however, and where the requisite buildings and demand for milk exist, the above policy would appear to be attractive. This may be shown by estimates of



the financial results of the ordinary and the suggested systems of management. On the typical holding cropped and stocked as first mentioned the principal items in the annual account are roughly as follows:—

<i>Expenses</i>				<i>Returns</i>			
			£				£
Rent and rates	...	...	250	Milk: 24 × 650 gal. @ 1/2	...	...	910
Labour	...	...	260	Calves: 12 @ £3	...	...	36
Help in haymaking	...	...	10	Fat cows: 5-6 @ £24...	...	...	132
Concentrates: 24 × 15 cwt.				Corn: 10 acres @ £9	...	...	90
@ 11/-	...	...	198				
Horse corn	...	...	45				
Other expenses and profit	...	...	405				
			<u>£1,168</u>				<u>£1,168</u>

In the above example the average daily allowances of home-grown foods per cow equivalent during a winter of 190 days are:—roots (18 tons per acre), 33 lb.; hay (25 cwt.), 16 lb.; and straw (30 cwt.), 5 lb.

If the farm were cropped as 75 acres pasture and 25 acres arable, it would carry 30 cows and heifers and 20 young stock. The additional returns and expenses would probably be the following:—

<i>Additional Expense</i>				<i>Additional Returns</i>			
			£ s.				£ s.
Labour: third man in place of youth, less special hay labour	...	...	42 0	Milk: 6 × 650 gal. @ 1/2	...	227	10
Concentrates: 6 @ £8 5s.			49 10	Calves: 5 @ £3	...	15	0
Hay: 40 × 8 lb. × 190 days = 27½ tons @ £4	...	...	109 0	Fat cows: 2 @ £24	...	48	0
Wet grains: 40 × 14 lb. × 190 days = 47½ tons @ 25/- (6d. bus.)	...	...	59 8	Corn: 2½ acres @ £9	...	22	10
Balance = advantage	...	...	53 2				
			<u>£313 0</u>				<u>£313 0</u>

No account has been taken of the manurial residues brought on to the farm in the purchased hay and grains: if properly conserved and utilised these would amount to a further advantage of £40 per annum. But without meadow land and with only 25 acres arable, it is doubtful whether proper use could be made of all the manure produced, viz., about 250 to 300 tons per annum. Better use of the manure is made where the farmer cultivates a greater acreage of crops that require liberal manuring—mangolds, marrow stem kale, potatoes or sugar beet. The system in fact lends itself to the inclusion of cash crops whereby manurial constituents are exported from the farm.

The main point of the above argument is that full use should be made of pasture: by slagging and by increasing the proportion of pasture at the expense of the hay land, increased numbers of cattle may be kept in summer: the limit may be set by labour considerations. As regards winter keep, I doubt whether any arable crop can be grown which will produce food at a less cost per unit than wet grains at 6d. per bushel delivered. The question of whether the dairy farmer could advantageously substitute part of his hay crop or replace part of his corn area with arable fodder crops—mixed cereals for hay or for silage, additional mangolds and marrow stem kale—is under investigation.

\* \* \* \* \*

## MONTHLY NOTES ON FEEDING STUFFS.

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**Water Consumption of Farm Animals.**—A correspondent has raised an interesting and apparently simple question which is however, more difficult to answer than would at first sight appear to be the case. The question was:—What is the daily quantity of water required by (1) a cow, (2) a year-old heifer, (3) a horse, during the grazing season? Simple though the question is, there appear to be few accurate data available upon which an answer can be based.

The water requirements of animals are met in several different ways. Firstly, a fair proportion of water is supplied in the food, particularly in the case of succulent feeding stuffs such as roots, grass and green forage crops. Thus, a bullock consuming 1 cwt. of roots receives over 9 gallons of water a day from this source. Concentrated feeding stuffs supply in the form of water about 1 gallon to  $1\frac{1}{2}$  gallons to every cwt., whereas grass and green succulent foods supply approximately 8 gallons of water for every cwt. of food consumed. The excess water required by the animal is generally obtained in the liquid form as drinking water. There is another source of water that is often overlooked, that is, water that results from the various chemical processes that go on in the animal's body. When starch, fat or protein is broken down in the animal's body, water is always an end product, and a certain amount of water becomes available for the animal's needs in this way. Thus



a pound of fat in breaking down in the animal's body yields more than its own weight of water, and a pound of starch or sugar similarly yields more than half its weight of water. This fact is illustrated by the interesting experiment of breeding weevils in desiccated flour, when it will be found that, although the larvae have never had access to water their bodies contain a large proportion of water, which can only have arisen from the chemical changes which have taken place in the food ingested.

The sources of gain of water to an animal are :—(1) Natural moisture in the food, (2) drinking water, and (3) water derived from metabolic processes. The sources of loss from the animal are :—(1) Water in dung and urine, and (2) water evaporated from the lungs and skin.

The amount of water consumed as drinking water will therefore largely depend upon the succulence of the food fed—the more succulent the food, the less drinking water will be required. The amount of water lost from the body will depend largely on the temperature of the animal's surroundings and the relative dryness of the atmosphere. This variable desire for water is well shown in the case of sheep. In the winter and spring sheep consume little or no water, whereas in a hot and dry summer special provision has to be made for drinking water for them. The demands of an animal for water will therefore vary considerably according to several factors—*i.e.*, dryness of atmosphere, temperature and state of succulence of the ration, and it is not possible to state accurately how much drinking water an animal will require. Kellner states an average based upon the dry matter of the food in the ration, *i.e.*, for horses, 2 to 3 lb. of water for every lb. of dry matter in the ration, and for cows 4-6 lb. of water for every lb. of dry matter in the ration. On this basis a horse eating 20 lb. of dry matter would require 6 gallons of water, and a cow eating 25 lb. dry matter would require 10 to 15 gallons of water a day. If roots or green succulent food were included in the ration, the demand for water would be considerably less.

In order to illustrate the distribution of water between the food, drinking water, urine and dung, the data obtained from an experiment carried out with oxen by Kellner nearly 30 years ago are of interest. Two full-grown oxen were used, one being fed with nearly 18 lb. of meadow hay, the other with nearly 20 lb. of a meadow hay and oat straw mixture. Both oxen drank daily 57 lb. of water, the food eaten contained approximately

DESCRIPTION.	Price per Qr.		Price per Ton.		Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.		Price per lb. Starch Equiv.	Percent of Digest. Crude Protein %.
	s. d.	lb.	£	s.	£	s.	£	s.		s.	d.		
Wheat, British -	—	—	12	5	0	16	11	9	71.6	3/2	—	1.70	10.2
Barley, British Feeding	—	—	9	10	0	12	8	18	71	2/6	—	1.34	6.5
" Canadian:—													
No. 4 Western	36/3	400	10	3	0	12	9	11	71	2/8	—	1.43	6.5
" Feeding	33/6	"	9	8	0	12	8	16	71	2/6	—	1.34	6.5
" American	36/9	"	10	5	0	12	9	13	71	2/9	—	1.47	6.5
" Danubian	36/0	"	10	2	0	12	9	10	71	2/8	—	1.43	6.5
" Karachi -	36/3	"	10	3	0	12	9	11	71	2/8	—	1.43	6.5
Oats, English, White	—	—	10	0	0	13	9	7	59.5	3/2	—	1.70	8.0
" " Black and Grey	—	—	9	13	0	13	9	0	59.5	3/0	—	1.61	8.0
" Canadian:—													
No. 2 Western	30/9	320	10	15	0	13	10	2	59.5	3/5	—	1.83	8.0
Argentine -	26/6	"	9	5	0	13	8	12	59.5	2/11	—	1.56	8.0
Chilian -	28/3	"	9	18	0	13	9	5	59.5	3/1	—	1.65	8.0
Maize, Argentine -	40/6	480	9	8	0	13	8	15	81	2/2	—	1.16	7.1
" Australian	40/6	"	9	8	0	13	8	15	81	2/2	—	1.16	7.1
Beans, English Winter	—	—	10	15	1	12	9	3	67	2/9	—	1.47	20.1
" Chinese	—	—	11	10	1	12	9	18	67	2/11	—	1.56	20.1
Peas, English Maple	—	—	11	7	1	8	9	19	69	2/11	—	1.56	19.4
" Japanese -	—	—	23	15†	1	8	22	7	69	6/6	—	3.48	19.4
Dari, Egyptian -	—	—	10	10	0	15	9	15	75.2	2/7	—	1.38	7.7
" Persian -	—	—	11	5	0	15	10	10	75.2	2/10	—	1.52	7.7
Millers' Offals:—													
Bran, British -	—	—	7	5	1	7	5	18	45	2/7	—	1.38	10.9
" Broad -	—	—	8	15	1	7	7	8	45	3/3	—	1.74	10.9
Middlings—													
Fine Imported	—	—	9	0	1	2	7	18	72	2/3	—	1.20	12.6
Coarse, British	—	—	8	2	1	2	7	0	64	2/2	—	1.16	11.5
Pollards, Imported	—	—	7	2	1	7	5	15	60	1/11	—	1.03	11.6
Meal, Barley -	—	—	11	12	0	12	11	0	71	3/1	—	1.65	6.5
" Maize -	—	—	10	10	0	13	9	17	81	2/5	—	1.29	7.1
" " South African	—	—	9	7†	0	13	8	14	81	2/2	—	1.16	7.1
" " Germ -	—	—	9	0	0	19	8	1	85.3	1/11	—	1.03	18.4
" " Gluten Feed	—	—	10	5	1	7	8	18	75.6	2/4	—	1.25	20.0
" Locust Bean -	—	—	9	15	0	9	9	6	71.4	2/7	—	1.38	4.0
" Bean -	—	—	13	0	1	12	11	8	67	3/5	—	1.83	20.1
" Fish -	—	—	20	10	4	7	16	3	53	6/1	—	3.26	50.0
Linseed -	—	—	22	7	1	11	20	16	119	3/6	—	1.87	19.4
" Cake, English	—	—	13	15	1	18	11	17	74	3/2	—	1.70	25.3
" " 12% Oil	—	—	12	17	1	18	10	19	74	3/0	—	1.61	25.3
" " 10% Oil	—	—	12	12	1	18	10	14	74	2/11	—	1.56	25.3
" " 9% Oil	—	—	12	12	1	18	10	14	74	2/11	—	1.56	25.3
Soya Bean Cake 6% Oil	—	—	10	15	2	14	8	1	69	2/4	—	1.25	38.2
Cottonseed Cake, English	—	—	7	15	1	15	6	0	42	3/0	—	1.61	17.6
" " Egyptian	—	—	7	10	1	15	5	15	42	2/9	—	1.47	17.6
Decorticated Cotton	—	—	7	10	1	15	5	15	42	2/9	—	1.47	17.6
Seed Cake 7% Oil -	—	—	12	17*	2	14	10	3	71	2/10	—	1.52	34.6
" Meal 7% Oil -	—	—	11	2	2	14	8	8	74	2/3	—	1.20	36.3
Ground Nut Cake 7% Oil	—	—	10	5*	1	16	8	9	56.8	3/0	—	1.61	42.0
Palm Kernel Cake 6% Oil	—	—	8	0†	1	3	6	17	75	1/10	—	0.98	17.1
" Meal 2% Oil	—	—	8	0	1	4	6	16	71.3	1/11	—	1.03	17.1
Feeding Treacle -	—	—	7	2	0	8	6	14	51	2/8	—	1.43	1.1
Brewers' Grains:—													
Dried Ale -	—	—	8	0	1	4	6	16	49	2/9	—	1.47	14.0
" Porter -	—	—	7	10	1	4	6	6	49	2/7	—	1.38	14.0
Wet Ale -	—	—	1	4	0	9	0	15	15	1/0	—	0.54	4.8
" Porter -	—	—	0	17	0	9	0	8	15	-/6	—	0.27	4.8
Malt Culms -	—	—	8	5†	1	14	6	11	43	3/1	—	1.65	19.9

\* At Bristol. † At Liverpool. ‡ At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March and are, as a rule, considerably lower than the prices at local country markets, the difference being due to cartage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton. Its manurial value is £1 3s. per ton. The food value per ton is therefore £8 17s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his local market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s.; P<sub>2</sub>O<sub>5</sub>, 4s. 6d.; K<sub>2</sub>O, 2s. 6d.



3½ lb. of water, and the water in the dung and urine amounted to 50 lb. The total water ingested amounted therefore to approximately 6 gallons, and the water excreted in the dung and urine amounted to 5 gallons. The oxen averaged approximately 12 cwt. live weight and the room temperature was approximately 61° F. These figures are from an accurately controlled experiment, and indicate that a bullock fed on hay and roughage would require 6 gallons of water a day, but if the ration included 70 lb. of roots, the water in the ration would be sufficient for the animal's normal requirements.

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FARM VALUES.

CROPS.	Market	Value	Starch	Food	Manurial	Value per
	Value per lb. S.E. d.	per unit S.E. s. d.		Value per Ton. £ s.	Value per Ton. £ s.	Ton on Farm. £ s.
Wheat - - - - -	1.16	2 2	71.6	7 15	0 16	8 11
Oats - - - - -	1.16	2 2	59.5	6 9	0 13	7 2
Barley - - - - -	1.16	2 2	71.0	7 14	0 12	8 6
Potatoes - - - - -	1.16	2 2	18.0	1 19	0 4	2 3
Swedes - - - - -	1.16	2 2	7.0	0 15	0 2	0 17
Mangolds - - - - -	1.16	2 2	6.0	0 13	0 3	0 16
Beans - - - - -	1.16	2 2	67.0	7 5	1 12	8 17
Good Meadow Hay - - -	1.47	2 9	31.0	4 5	0 14	4 19
Good Oat Straw - - -	1.47	2 9	17.0	2 7	0 7	2 14
Good Clover Hay - - -	1.47	2 9	32.0	4 8	1 0	5 8
Vetch and Oat Silage - -	1.34	2 6	14.0	1 15	0 7	2 2
Barley Straw - - - -	1.47	2 9	19.5	2 14	0 6	3 0
Wheat Straw - - - -	1.47	2 9	11.0	1 10	0 4	1 14
Bean Straw - - - -	1.47	2 9	19.0	2 12	0 9	3 1

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## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending April 15th.				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
Nitrate of Soda (N. 15½ per cent.) ... ..	£ s. 13.15	£ s. 13.17	£ s. 13. 0	£ s. 13. 0	s. d. 16. 9
" " Lime (N. 13 per cent.) ... ..	... ..	12.10	...	12.12	19. 5
Sulphate of Ammonia, ordinary (N.20.7. per cent.)	13.11*	13.11*	13.11*	13.11*	(N)13.1
" " " neutral (N. 21.1 per cent.)	14.14*	14.14*	14.14*	14.14*	(N)13.11
French Kainit (Pot. 20 per cent.) ... ..	3. 2	3. 0	...	2.15	2. 9
" " (Pot. 14 per cent.) ... ..	2.17	2.15	2. 7	2.10	3. 7
Potash Salts (Pot. 30 per cent.) .. ..	...	...	3.17	3.15	2. 6
" " (Pot. 20 per cent.) ... ..	...	...	2.17	2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7.10	7. 5	7. 5	2.11
Sulphate of Potash (Pot. 48 per cent.) ...	12.10	11.15	11.10	11.10	4. 9
Basic Slag (T.P. 30 per cent.) ... ..	3. 2§	...	2.12§	2.12§	1. 9
" " (T.P. 28 per cent.) ... ..	...	2. 1†	...	2.10§	1.10
" " (T.P. 26 per cent.) ... ..	...	1.14†	...	2. 8§	1.10
" " (T.P. 24 per cent.) ... ..	...	1.11†	2. 0§	2. 6§	1.11
Superphosphate (S.P. 35 per cent.) ... ..	...	...	3.15	3. 8	1.11
" " (S.P. 30 per cent.) ... ..	3. 7	3. 5	3. 8	3. 2	2. 1
Bone Meal (N. 3¼, T.P. 45 per cent.) ...	9.10	8. 5	8.10	8. 0	...
Steamed Bone Flour (N. ¾, T.P. 60 per cent.)	6.15†	7. 0†	6.10	6. 0†	...
Fish Guano (N. 7½-8½, T.P. 16-20 per cent.)	...	...	13. 0	...	...
" " (N. 9, T.P. 10 per cent.) ... ..	...	...	...	12. 5	...

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ F.o.r. Works.

§ Prices include cost of carriage from works to town named, and at London are for not less than 4-ton lots. Cost to purchasers in other districts will be greater or less according to the distances of different purchasers from the works.

\* \* \* \* \*

## MISCELLANEOUS NOTES.

In May, 1924, a Committee was appointed by the Ministry of Agriculture to formulate a scheme for testing agricultural machinery, as recommended by the Machinery Advisory Committee. That Committee has now worked out its scheme and presented it to the Ministry.

Besides providing for the tests, the scheme requires that official certificates and reports shall be issued which will give farmers, distributors and manufacturers accurate and independent information regarding the utility, efficiency, reliability, working cost, and maintenance of each machine or implement tested. Machinery and implements of either home manufacture or overseas manufacture submitted through an accredited



agent in this country will be eligible for testing, but scale models will not be admitted. The cost of testing will be borne by the entrant in accordance with a schedule of fees which has been drawn up by the Committee, and set out in an appendix to the report. The Committee has drawn up general regulations to govern the admission of machines and implements for testing, a form of entry, and forms of certificate and report to be issued by the Ministry. It is recommended also that a small permanent Committee should be appointed to assist the Ministry in carrying out the testing scheme.

The Ministry proposes to appoint a permanent Committee, as recommended, and is preparing the necessary forms and instructions for enabling applications for individual tests of machinery to be dealt with. It is not proposed to publish the Report, of which this is a short summary, but copies of it may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

\* \* \* \* \*

In the Report on the Agricultural Production of England and Wales, recently issued by the Ministry,\* the results of the

**The Importance  
of the Poultry  
Industry.**

returns so far as the production of poultry and eggs is concerned are summarised as follows:—

“The returns collected in 1924\* show that the number of fowls on agricultural holdings in England and Wales was substantially greater than at the previous census in 1921. The number of fowls of a year old or more was 15,123,000, and of these approximately  $13\frac{3}{4}$  millions would be hens. At an average annual production of 100 eggs per hen, the total production of eggs on agricultural holdings in England and Wales would be about 1,375 millions, against 1,100 millions, the estimated production in 1922. It must be remembered that these figures do not represent the total production of eggs in the country, as they do not include the produce from fowls kept by occupiers of less than an acre or those kept in towns or suburban areas. It has been previously suggested that an addition of about one-third should be made for fowls not on agricultural holdings, and on this basis, the total production of eggs in England and Wales in 1924 would be about 1,800 millions.

“In the Report for 1922 it was stated that the number of poultry killed for food in any year might be estimated as

\* Agricultural Statistics, 1924, Vol. 59, Part II.

approximately equal to the number of poultry hatched in that year and alive on 4th June. The number of poultry reared on agricultural holdings and killed for food in 1924 may, therefore, be estimated at: Fowls, 15,630,000; ducks, 1,420,000; geese, 400,000; and turkeys, 535,000. The estimated number of fowls and turkeys killed was much greater in 1924 than in 1921."

Mr. Edward Brown, of the National Poultry Council, in a letter to *The Times*, 30th March, 1925, puts the value of the eggs and poultry consumed in Great Britain in 1924 at nearly 40 million pounds sterling, of which a little more than 17 million sterling was home-produced. He also puts the poultry industry as about equal in value of outturn with that of wheat-growing.

The Minister of Agriculture had already recognised the growing importance of the poultry industry, and has asked the National Farmers' Union and the Poultry Trade to nominate members to serve upon his Poultry Advisory Committee. Its Chairman is the Ministry's Poultry Commissioner, Mr. Percy Francis, and its other members are Mr. Edward Brown and Mr. W. Brownson (Joint Secretaries of National Poultry Council), Mr. Hedworth Foulkes, B.Sc., Mr. W. Hammett (Lancs.), Mr. Tom Newman (Secretary, Scientific Poultry Breeders' Association), Mr. S. Street-Porter (Eastern Counties), Mr. T. R. Robinson (Secretary, National Utility Poultry Society), Col. S. Sandbach (Wales), and Mr. A. T. Walker (Lancs.).

To this body is now added the name of Mr. Harry German, Past President of the National Farmers' Union and Chairman of the Cereals, Livestock and Wool Committee of the Union; and Mr. A. S. Juniper, and Mr. Ambrose Keevil, O.B.E., both of the Central Markets, West Smithfield, London, E.C., who are appointed to represent the trade.

\* \* \* \* \*

PRICES of agricultural produce during March averaged 65 per cent. above those ruling in the corresponding month of 1911-13,

**The Agricultural Index Number.** as compared with 67 per cent. above in the previous month. Most commodities were cheaper than in February, and the decline of 2 points on the month was chiefly accounted for by the fall in grain prices and to the fact that the advances in fat cattle and sheep were not proportionally so large as in the base years.



In March, 1924, the percentage increase was 57 per cent. above pre-war level or 8 points lower than at present.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING  
MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.	1924.	1925
January ...	200	183	75	68	61	70
February ...	195	167	79	63	61	67
March ...	189	150	77	59	57	65
April ...	202	149	70	54	53	—
May ...	180	119	71	54	56	—
June ...	175	112	68	51	58	—
July ...	186	112	72	53	52	—
August ...	193	131	67	54	59	—
September	202	116	57	56	60	—
October ...	194	86	59	51	63	—
November	193	79	62	53	64	—
December	184	76	59	56	63	—

Wheat declined in price, and on the average was 4d. per cwt. cheaper than in February, the index figure recording a drop of 4 points, but wheat remained comparatively dear at 79 per cent. above pre-war. Barley showed a much sharper fall, values declining by 1s. 4d. per cwt. on the month, while oats were reduced by 4d. per cwt. The index figure for barley declined from 59 to 45 per cent. above 1911-13, and is at exactly the same level as a year ago, while oats, which fell from 42 to 38 per cent. above the base years, are 1 point lower than in March, 1924.

Fat cattle and sheep were slightly dearer, but the increases were relatively less than in pre-war years, and the index numbers show a decline of 2 and 3 points respectively. Bacon pigs advanced in price from 11s. 1d. to 11s. 8d. and porkers from 11s. 10d. to 12s. 4d. per 14 lbs. stone, the index figure for baconers rising from 62 to 67 per cent. above that of the basic years, while porkers rose from 60 to 66 per cent. above.

Trade was quiet for dairy cattle and, on the average, prices were £1 5s. per head lower than in February, the index number falling 2 points on the month. Store sheep and pigs again advanced in value, and the former were more than twice as dear as in the base years, while store pigs were 47 per cent. dearer.

Butter prices declined 1d. per lb., the index number falling to 58 per cent. above 1911-13 as compared with 63 per cent. above a year ago. Eggs were 2d. per dozen cheaper than in March last year and declined by about 7d. per dozen as compared with February of this year, the percentage increase falling by 13 points to 49 per cent. above the pre-war price. Cheese

was 6s. per cwt. dearer than in the previous month, and the index figure rose 7 points. Milk, on the average, was slightly cheaper owing to a reduction in price of  $\frac{1}{2}$ d. per gallon at Manchester, and the percentage increase fell to 82 per cent. above 1911-13.

Potatoes were rather cheaper than in the previous month, and as values usually advance in March the increase over pre-war years declined from 144 to 138 per cent. Several descriptions of vegetables became dearer, and the average for all kinds, not including potatoes, rose from 74 to 91 per cent. above the base years. Brussels sprouts were considerably dearer, prices advancing from 13s. 9d. to 18s. per cwt., the latter figure being 140 per cent. higher than in 1911-13, an increase of nearly 80 points on the month. Celery was unchanged in price, but with a fall in values in the base years the index figure shows an increase of over 20 points as compared with February. Onions sold at 12s. per cwt. as against 11s. in February, and at the former price were more than twice as dear as in 1911-13. Cauliflowers were 3d. per dozen dearer, but this increase was relatively less than in pre-war years, and the index number dropped about 20 points on the month. Cabbage again sold at 40 per cent. above 1911-13 prices.

Hay was about 2s. per ton cheaper than in February, and sold at slightly less than in the base years.

Index numbers of different commodities during recent months and in March, 1923 and 1924, are shown below:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1923.	1924.		1925.		
	Mar.	Mar.	Dec.	Jan.	Feb.	Mar.
Wheat ...	27	46	67	76	83	79
Barley ...	8	45	76	81	59	45
Oats ...	36	39	37	46	42	38
Fat cattle ...	54	52	44	52	53	51
Fat sheep ...	94	64	84	107	100	97
Baconers . .	69	26	49	57	62	67
Porkers ...	82	37	49	59	60	66
Dairy cows ...	58	64	55	53	50	48
Store cattle ...	31	41	37	43	46	43
Store sheep ...	92	85	85	102	100	104
Store pigs ...	136	45	38	49	48	47
Eggs... ..	55	68	51	82	62	49
Poultry ...	81	59	64	63	56	57
Milk ... ..	87	71	84	84	84	82
Butter ...	70	63	73	73	62	58
Cheese ...	95	71	51	49	50	57
Potatoes ...	—12*	173	166	152	144	138
Hay ... ..	42	1	2	1	0	—1*

\* Decrease.



THE Scheme whereby smallholders and cottagers who keep milch goats have been obtaining the services of first-class stud goats for breeding purposes at a maximum fee of 5s., has proved so successful during the past season that it has been decided to continue it for another season. Although complete results are not yet to hand, it may be stated that during the season just ended, 75 stud goats were registered and 882 services given. It is hoped that these figures will be exceeded during the forthcoming season.

**Stud Goat  
Scheme.**

Stud goats complying with certain specified conditions are eligible for registration under the Scheme, particulars of which may be obtained from the British Goat Society which is administering the Scheme. Goat owners are reminded that applications for the registration of stud goats should be made direct to the Hon. Secretary, British Goat Society, 10, Lloyd's Avenue, E.C.3, not later than 1st June. It is *not* necessary that such applicants should be members of the Society.

\* \* \* \* \*

THE Twelfth International Congress of Agriculture will be held in Warsaw from 21st to 24th June, 1925. The Congress will be composed of official delegates of Governments and of agricultural institutions and organisations belonging to countries which are represented on the International Commission of Agriculture. The programme of the Congress has been divided into five sections—rural economy, crop production, livestock production, agricultural industries, agricultural research and education. Each section will deal with no more than 5 to 7 problems.

**International  
Congress of  
Agriculture.**

The fee for members of the Congress has been fixed at 10 zloty (30 French francs), which gives the right to take part in all the sittings and receive copies of the general report of the Congress free of charge. The languages to be employed for verbal communications will be Polish, French and English. Up to the middle of March over one hundred papers from sixteen different countries had been promised to the Congress.

The Congress will be followed by an excursion from 25th to 29th June, at a fixed price, to agricultural enterprises, experimental fields, agricultural schools, exhibitions, etc., as well as to interesting parts and beauty spots in Poland, including the famous virgin forest of Bialowieza and Cracow—"a gem of the middle ages."

THE Director of the Rothamsted Experimental Station, Sir John Russell, again extends a cordial invitation to farmers' and farm workers' associations and clubs, chambers of agriculture and horticulture, students' societies and other bodies interested in agriculture or market gardening to inspect the Rothamsted Experimental Plots during the coming summer. Mr. H. V. Garner, B.A. (Camb.), will be available to demonstrate the Plots at any time, and all who come can be certain that under his guidance their visit will prove both useful and interesting.

Among important items of interest are: experiments on the manuring of arable crops, especially wheat, barley, mangolds, potatoes; manuring of meadow hay; effect of modern slugs and mineral phosphates on grazing land, hay land, and arable crops; crop diseases and pests; demonstrations of good types of tillages. At any convenient time from May to 30th October there is sufficient to occupy a full day, and there is provision for assuring that the time shall not be lost, even if the weather turns out too bad to allow of close investigation of the fields.

Sir John Russell will be happy to arrange full details with organisations of farmers, farm workers and others wishing to accept this invitation; small groups of farmers are specially welcomed. If possible, arrangements should be made beforehand; but it is recognised that farmers' movements must often depend on the weather, and no farmer need stay away because he has been unable to write fixing a date.

All communications and requests to visit the Station should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden. It would be a convenience if ample notice could be given so as to avoid the possibility of dates clashing.

\* \* \* \* \*

**Foot-and-Mouth Disease.**—Only two fresh outbreaks of the disease have been discovered since the publication of the April issue of the *Journal*. These were at Wadsley Bridge, near Sheffield, on 26th March. The usual restrictions were imposed on the movement of animals and the holding of markets, etc., in areas of about 15 miles radius round these outbreaks. All restrictions in connection with the former outbreak have now been withdrawn.

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## ADDITIONS TO THE LIBRARY.

### Field Crops.

*Dowling, P. N.*—Sugar Beet from Field to Factory. (72 pp.) London: Benn. 1925. 2s 6d. [63.3433.]



*Leeds University and the Yorkshire Council for Agricultural Education.*—Bull. 139 :—Varieties Trials with Potatoes in Yorkshire, 1924. (16 pp.) Leeds, 1925. [63.512-194.]

*Chilean Nitrate Committee.*—The Manuring of Hops. (20 pp.) London : Chilean Nitrate Committee, 1925, gratis. [63.3451-16.]

#### Fruit Growing.

*South Eastern Agricultural College.*—Fruit Bull 10 :—Fruit Pollination in Relation to Commercial Fruit Growing. (8 pp.) Wye, 1925, 1s. [63.41(08).]

#### Plant Pests and Diseases.

*Van den Broek, M., and Schenk, P. J.*—Ziekten en Beschadigingen der Tuinbouwgewassen. (360 pp.) Groningen : J. B. Wolters, 1925, f3.50. [63.2.]

*West of Scotland Agricultural College.*—Bull. 103 :—The Grub Pest (Leather Jacket) and Paris Green as a Remedy. (10 pp.) Glasgow, 1925. [63.27.]

#### Live Stock.

*Day, G. E.*—Productive Swine Husbandry. 4th edition. (384 pp.) Philadelphia and London : J. B. Lippincott, 1925, 12s. 6d. [63.64.]

*Fielding, A. E. Bruce.*—Pig-keeping Do's and Dont's. (90 pp.) London : Methuen, 1925, 2s. 6d. [63.64.]

#### Veterinary Science.

*Kaupp, B. F.*—Animal Parasites and Parasitic Diseases. 4th edition. (250 pp.) London : Baillière, Tindall & Cox, 1925, 12s. 6d. [63.169.]

*U.S. Department of Agriculture.*—Dept. Bull. 1245 :—Stock-Poisoning Plants of the Range. (36 pp. + xliii pl.) Washington, 1924. [63.255.]

#### Poultry.

*Punnett, R. C.*—Sex-Linkage for Egg Production and Table Poultry. (32 pp.) London : "Daily Mail," 1925, 1s. [63.651; 575.1.]

*Missouri Agricultural Experiment Station.*—Bull. 225 :—The Influence of Animal and Vegetable Proteins on Egg Production. (16 pp.) Columbia, 1924. [63.651 : 043.]

#### Economics.

*Carver, T. N.*—Elements of Rural Economics. (266 pp.) Boston and London : Ginn & Co., 1924, 7s. [338.1.]

*Spillman, W. J., and Lang, E.*—The Law of Diminishing Returns :—Part I. The Law of Diminishing Increment.

Part II. The Law of the Soil.

(178 pp.) New York : World Book Co.; London : Harrap, 1924. [338.1.]

*Valgren, V. N.*—Farmers' Mutual Fire Insurance in the United States. (186 pp.) Chicago : University Press; London : Cambridge University Press, 1924, 9s. 6d. [368.1.]

*U.S. National Council of Farmers' Co-operative Marketing Associations.*—Proceedings of the Third National Co-operative Marketing Conference, Washington, January, 1925. (136 pp.) Washington, 1925, \$1. [334.6.]

*U.S. Department of Agriculture.*—Dept. Bull. 1302 :—Development and Present Status of Farmers' Co-operative Business Organisations. (76 pp.) Washington, 1924. [334(73).]

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## SELECTED CONTENTS OF PERIODICALS.

#### Agriculture, General and Miscellaneous.

The History of Agriculture in Wales, *C. Bryner Jones.* (Welsh Jour. Agr., vol. i, No. 1 (Jan., 1925), pp. 5-16.) [63(09); 63(42).]

Field Experiments with Various Types of Phosphatic Manures, 1924. Jour. Dept. Lands and Agr. (Dublin), vol. xxiv, No. 4 (Feb., 1925), pp. 424-433.) [63.1672.]

Spraying for Weed Eradication, *W. E. Brenchley.* (Jour. Bath and W. and S. Counties Soc., vol. xix (1924-25), pp. 1-20.) [63.259.]

**Field Crops.**

- Investigations on Yield in the Cereals. II. A Spacing Experiment with Wheat, *F. L. Engledow*. (Jour. Agr. Sci., vol. xv, part 2 (April, 1925), pp. 125-146.) [63.311.]
- Potato Growing for Seed Purposes, *W. D. Davidson*. (Jour. Dept. Lands and Agr. (Dublin), vol. xxiv, No. 4 (Feb., 1925), pp. 374-423.) [63.512.]
- Seed Mixtures for Temporary Grass: Investigations Conducted in Denmark and Sweden, and Observations on Trials of a similar nature in progress at Aberystwyth, *R. G. Stapledon* and *R. Jones*. (Welsh Jour. Agr., vol. i, No. 1 (Jan., 1925), pp. 60-98.) [63.33(b).]
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- Apple Packing Station: Progress in England, *H. V. Taylor*. (Jour. Pomol. and Hort. Sci., vol. iv, No. 2 (Jan., 1925), pp. 113-116.) [63.41-198.]

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- Animal Nutrition with Special Reference to the Rearing of Young Stock, *E. J. Sheehy*. (Jour. Dept. Lands and Agr. (Dublin), vol. xxiv, No. 4 (Feb., 1925), pp. 335-342.) [63.604.]
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- Feeding the Cow According to her Yield, *J. Wilson*. (Jour. Dept. Lands and Agr. (Dublin), vol. xxiv, No. 4 (Feb., 1925), pp. 343-350.) [63.711 : 043.]
- The Causes of Variations in Milk Records, *J. Hammond* and *H. G. Sanders*. (Jour. Bath and W. and S. Counties Soc., vol. xix (1924-25), pp. 20-34.) [612.664; 63.711(b).]

**Economics.**

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- Farm Costings, *J. M. Adams*. (Jour. Dept. Lands and Agr. (Dublin), vol. xxiv, No. 4 (Feb., 1925), pp. 351-373.) [338.58; 338.1(415).]
- Farmers and the Grain Trade in the United States: An Interpretation of the Present Pooling Movement, *J. E. Boyle*. (Economic Jour., vol. xxxv, No. 137 (March, 1925), pp. 11-25.) [334(73); 63.311 : 38.]
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# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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JULY, 1923.

## NOTES FOR THE MONTH.

THE Departmental Committee on Distribution and Prices of Agricultural Produce appointed by the Minister of Agriculture

**Report on  
Fruit and  
Vegetables.**

and Fisheries has now issued a second interim report\* which deals with fruit and vegetables. A note on the first report, which concerned milk and milk products, appeared in the May issue of this *Journal*, p. 100. The Committee consists of the Marquess of Linlithgow (Chairman); Sir Basil Mayhew, K.B.E.; Mr. A. W. Ashby; Mr. E. R. Debenham; Dr. C. M. Douglas, C.B.; Mr. P. A. Hurd, M.P.; Mr. R. R. Robbins, C.B.E.; Mr. R. J. Thompson, O.B.E.; and Mrs. Margaret Wintringham, M.P.

The Committee has been at considerable trouble to obtain authoritative information from numerous producers', distributors' and consumers' organisations, and from other sources which were available. As a result the report is a mine of pertinent information on the organisation of the fruit and vegetable trade. It is illustrated by various interesting diagrams.

Growers should purchase the Report and study it for themselves, but it may be of interest to quote the concluding passages of the Report:—

“ Finally, the picture presented to us by the evidence we have received is that of an industry deeply disturbed by war and post-war conditions. The less progressive growers and distributors appear to be waiting for a return to pre-war conditions. The more progressive growers and distributors, on the other hand, are fully alive to the needs of the moment. Perceiving the widespread change in prices and conditions of

\* Second Interim Report of the Departmental Committee on Distribution and Prices of Agricultural Produce—Fruit and Vegetables. The Report can be obtained through any bookseller, or from H.M. Stationery Office, Imperial House, Kingsway, W.C.2 (price 3s.).

production and trade which are the aftermath of war, they are earnest in their endeavour to improve the methods and to lessen the costs of the various processes, whether of production or distribution, in which they are engaged. The best hope for the future lies with the industry itself. Producers must realise that marketing is the other half of production. They must make it their business to increase their knowledge of market conditions and requirements in order to dispose of their produce in the home markets to the best advantage in competition with produce grown in other lands. Distributors, for their part, must make every effort to eliminate archaic methods and to enhance the efficiency of the general distributive system. Retail distributors, in particular, should make serious efforts in the direction of increasing turnover when supplies are abundant, by charging lower prices to the consuming public. It should be the aim of all concerned in the industry to facilitate the passage of fruit and vegetables from the land to the home. The policy of preferring high prices and smaller turnovers to increased business on a lower price basis checks the even flow of supplies, and is inimical to the interests of the retailer himself, as, indeed, to the interests of all. In the course of this report we have set out numerous suggestions for improving the existing distributive machinery. Their cumulative effect upon the existing disparity ought to be substantial, and no opportunity of improvement, however slight, should be neglected."

\* \* \* \* \*

THE eleventh International Congress of Agriculture was held in Paris on the 22nd-26th May, and was attended by represen-

**International  
Congress of  
Agriculture in  
Paris.**

tatives from over twenty countries. The French Minister of Agriculture, M. Chéron, acted as Honorary President, and M. Méline, a former Minister of Agriculture, was President of this as of preceding Congresses. The Congress was indeed rendered possible by the financial assistance and help afforded by the French Government.

The work of the Congress was divided into seven sections, and in practice took the form of discussions on subjects in regard to which papers had been contributed, winding up in most cases with resolutions expressing in a more or less definite form the view of the meeting. It afforded an opportunity for an exchange of views and a statement of the experience of different countries on matters of common interest. In all, no



fewer than 87 separate contributions were included in the proceedings of the Congress.

The scope of the Congress was in consequence very wide and covered a great variety of subjects, but it may be of interest to give some indication of the questions dealt with in the different Sections.

The first Section (Agronomy) was mainly devoted to questions relating to the improvement of wheat, potatoes and beet. A proposal was made to establish an International Association for the breeding of improved varieties of wheat, the idea being to establish a central office which would record the characteristics of all known varieties, promote the exchange of information between wheat breeders in all parts of the world, and publish a bulletin summarising results obtained in the improvement of wheat. Among other subjects this Section made a Recommendation that the international law as to patents should be extended so as to afford legal protection to the names under which new varieties of wheat are sold.

The third Section (Rural Economy) was of a less technical and more general character, the subjects discussed including the improvement of the lot of the agricultural worker, the development of agricultural associations, the taxation of land and the question of agricultural book-keeping.

On this last subject a paper was contributed by Sir Daniel Hall, and in the discussion which followed M. Laur, President of the Union des Paysans of Switzerland, drew attention to the remarkable progress which had been made in Switzerland by the adoption of a system whereby a book-keeper was employed co-operatively by an Association of farmers on a system similar to that adopted by milk recording Societies. By this means accurate accounts were kept on a very large number of farms. This was not merely of benefit to the individual farmers concerned, but the statistics of profit and loss thus obtained were of great value in meeting the criticisms of urban consumers regarding the prices of commodities like milk or meat, and in affording a reliable indication of the position of the industry.

The Live Stock Section dealt with milk recording as a means of developing milk production by the selection of cows with a high milk and butter yield, and increasing their commercial value. An allied subject which attracted a good deal of interest was the possibility of securing uniformity in the methods of judging stock and the system of entry in herd books, and also uniformity of certificates of origin and sanitary certificates of animals intended for export.

Other Sections of the Congress concerned themselves with vine growing, forestry, rural education and Colonial agriculture.

The meeting concluded with an excursion to some of the experiment stations near Paris, followed by longer excursions into Normandy, the Nivernais, and the wine producing area in the east of France.

\* \* \* \* \*

THE Ministry's annual report on the prices and supplies of agricultural produce and requirements in 1922 has now been

**Prices and  
Supplies of  
Agricultural  
Produce in 1922.**

published. After reviewing the changes in prices and wages in 1922 as compared with previous years the position during the past 18 months is summed up by saying that while agricultural prices declined sharply in 1921. growers were able by reduced wages and reduced prices of feeding stuffs and fertilisers to produce more cheaply in 1922 than in the preceding year. This advantage, which might have enabled them to balance receipts against expenditure, was lost by the further fall in cereals and potatoes. The year was also unfavourable generally for growers of market garden crops, as the prices of these declined to about pre-war level when the heavy crops of 1922 came to be marketed. Some commodities, particularly sheep, realised fair prices.

The report contains a few short tables of the total supplies of the chief agricultural commodities in Great Britain, distinguishing the quantities produced at home from those imported. These tables bring out clearly the contribution which the agriculture of Great Britain makes to the total requirements, and show that the proportions of the total supplies which are produced at home vary considerably with the different kinds of agricultural produce.

With reference to these tables, it is observed that "These figures may be used to point to the extent of the dependence of Great Britain on imports, whether from Ireland or other parts of the Empire or from foreign countries. From another point of view it may be considered that having regard to the dense population of this country and its relatively small area the home contribution is fully as great as can be expected from the area of land available. But it must be admitted that the figures emphasize the magnitude of the market which lies at the door of the British agriculturist, and suggest that an expansion of home production in at least some of these directions ought not to be a matter of impossibility."



The report, which forms Part III of the Agricultural Statistics, 1922, is published by H.M. Stationery Office, and may be purchased through any bookseller, price 1s.

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ALTHOUGH there have been some appreciable changes in the prices of individual commodities, the general index number of

### The Agricultural Index Number.

the prices of agricultural produce remained unchanged in May at 54 per cent. above the level of 1911-13. On the whole therefore agricultural produce was some 10 per cent. lower in value than a year ago.

The following table shows the percentage increase in each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING  
MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ... ..	200	183	75	68
February ... ..	195	167	79	63
March ... ..	189	150	77	59
April ... ..	202	149	70	54
May ... ..	180	119	71	54
June ... ..	175	112	68	—
July ... ..	186	112	72	—
August ... ..	193	131	67	—
September ... ..	202	116	57	—
October ... ..	194	86	59	—
November ... ..	193	79	62	—
December ... ..	184	76	59	—

All classes of British grain realised higher prices than in April, wheat advancing by 11d. per cwt., barley by 5d. per cwt., and oats 8d. per cwt. Except in the case of barley there is usually a rise in May, but the increase this year has been relatively greater than before the War so that the index numbers increased by 3 to 6 points. Wheat at 37 per cent. above 1911-13 is higher than in any month since August last, but oats are still relatively dearer than wheat. Potatoes remained unchanged at 28 per cent. cheaper than in 1911-13, the slight fall in price in May being relatively the same as the decline in the base years. Hay usually becomes cheaper in the spring, but the decline this year was only 1s. per ton on the average, so that the index number shows a rise of one point. Hay is one of the few agricultural commodities which are dearer than a year ago, being now 41 per cent. above 1911-13 against 33 per cent. above in May, 1922.

Prices of fat cattle increased during May and were on the average about 3d. per stone higher than in April, this rise being

relatively greater than in the base years, and fat cattle realised prices 53 per cent. above those ruling in May, 1911-13, against an increase of 51 per cent. in April. As is usual, fat sheep and fat pigs declined in price, but the index number increased slightly in each case as the fall was relatively less than before the War. During May fat sheep were at rather more than double pre-war prices, and fat pigs 72 per cent. above. Dairy cattle have been in poor demand except for the best animals, and realised about £1 per head less than in April, being only 50 per cent. dearer than in 1911-13. Store cattle and sheep became dearer, but in each case they are relatively cheaper than fat stock. Store pigs, on the other hand, though cheaper than in April, were still at a much higher level than fat pigs.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.		1922.	1923.				
		May	Jan.	Feb.	Mar.	Apr.	May
Wheat	...	62	33	28	27	31	37
Barley	...	49	20	12	8	11	16
Oats	...	53	43	39	36	39	42
Fat cattle	...	70	61	61	54	51	53
Fat sheep	...	140	103	97	94	100	103
Fat pigs	...	91	102	88	77	71	72
Dairy cows	...	66	74	67	58	55	50
Store cattle	...	38	36	36	31	29	33
Store sheep	...	100	105	100	92	92	98
Store pigs	...	97	171	154	136	131	126
Eggs...	...	50	86	46	55	37	43
Poultry	...	110	81	80	81	75	77
Milk	...	27	90	90	87	70	63
Butter	...	54	73	72	70	68	40
Cheese	...	48	85	88	95	92	42
Potatoes	...	140	—1*	—5*	—12*	—28*	—28*
Hay	...	33	43	42	42	40	41

Owing to the decline in the prices of imported cheese, and the consequent lower prices paid for milk sent by producers in excess of their basic quantities, the average price of milk declined from 70 to 63 per cent. above the pre-war summer contract prices. The average price is, however, well above May, 1922, when the increase over 1911-13 was only 27 per cent. Butter showed a sharp fall in May, British butter at country markets averaging 1s. 4½d. per lb. against 1s. 10½d. in April, and was only 40 per cent. above the pre-war price. Cheese declined even more sharply and this season's cheese sold at only 42 per cent. more than in 1911-13, or 6 points lower

\* Decrease.



than in May, 1922. Eggs recovered from the low level of April and were 43 per cent. dearer than before the War.

\* \* \* \* \*

THE Denbigh and Flint Conciliation Committee has reached an agreement to cover the period May to November, 1923, providing that wages in the area shall be (a) in

**Conciliation  
Committees in  
Agriculture.**

the case of stockmen and horsemen 33s. for a week of 61 hours, to consist of 56 or 58 hours on weekdays and 5 or 3 hours respectively on Sunday, or 61 hours on weekdays, at the option of the employer; and (b) for other adult male workers 27s. 1d. for a week of 50 hours. A special clause stipulates that it is a fundamental condition of the agreement that the rates specified are minimum rates, and provision is also made for overtime, for rates for male workers under 21, for deductions from the cash wage in respect of allowances of board and lodging, and for a half-day being allowed on Saturdays wherever possible. The Merioneth and Montgomery Committee has also reached an agreement to continue to November, 1923, the terms being a rate of 31s. for 60 hours in the case of stockmen and wagoners, and a rate of 28s. for 52 hours in the case of other adult male workers. For Carnarvon an agreement has been made providing for a wage of 32s. 6d. (or 18s. in cash and board and lodging valued at 14s. 6d.) for a week of 60 hours. In the case of the Brecon and Radnor Committee an agreement has been reached on the recommendation of the Independent Chairman, providing for a rate for adult male workers of 30s. for a week of 53 hours.

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IN view of the references in the technical Press to *Aphelinus mali*, a Chalcid parasite of the Woolly Aphis, it may interest

**A Parasite of the  
Woolly Aphis.**

*Journal* readers to know that a flourishing colony of this parasite exists at the Ministry's Pathological Laboratory at Harpenden. By the kindness of Dr. Marchal, of Paris, a small supply of parasitised Woolly Aphis was received early in the year. The Chalcid flies emerged from the dead aphides during April and were introduced into a cage containing a small Cox's Orange Pippin heavily infested with Woolly Aphis. The Chalcids bred satisfactorily and at the date of writing a further generation of flies is appearing. It is hoped that before the close of the summer sufficient stock will be available to make a limited distribution of the parasite to one or two centres in fruit-growing districts, and that these centres will next year

be able to provide sufficient material for a more general distribution. It is quite impossible at present to predict whether the parasite will prove of real importance in the control of Woolly Aphis, but there is already sufficient evidence to show that an extensive trial is worth while. Further information on the subject will appear in this *Journal* as soon as the experiments are in a more advanced stage.

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THE provision of weigh-bridges in sale yards is not yet general throughout the country, though at most sale yards in Scotland and the north of England fat cattle pass over the weigh-bridge before entering the sale ring, and the same system is adopted at many markets in other districts of England and Wales.

**Weighing of  
Cattle: A  
Successful  
Experiment  
in Cornwall.**

During the War all cattle were graded and sold by live weight, and although the system was much abused by farmers at first, they soon found out by weighing their cattle and selling by live weight, that they had in many instances given away to butchers and dealers a considerable quantity of beef and mutton under the old system of selling their stock at so much per head.

The grading scheme was much appreciated by the majority of Cornish farmers, and when it came to an end the farmers wished to continue to sell their cattle by live weight. The butchers and dealers, and to a certain extent the auctioneers, were not in favour but preferred to buy the cattle as they stood at a price per head, and consequently strong opposition was forthcoming. The Cornish Farmers' Union, however, were strongly in favour of the scheme of selling by live weight, and it was only after they decided to appoint their own auctioneers that the other parties consented to give it a trial.

The system adopted at Truro, Helston and other markets in Cornwall is as follows:—An ex-soldier is appointed and paid by the Farmers' Union at the rate of 2d. for each head of stock weighed, with a minimum pay of 10s. per day. He has to superintend the weigh-bridge and book the weight of each beast, and as the animal enters the sale ring he calls out the live weight and this is booked down by the auctioneer's clerk. The bidding is then conducted at so much per live cwt., and the necessary calculation for the total price of the animal is afterwards worked out by the auctioneer's staff. In case of any dispute the weight



as booked by the ex-soldier is accepted as final. In cases where a fat cow or heifer is found, when slaughtered, to be in calf, a claim can be lodged by the purchaser with the auctioneer, and the vendor has to make some allowance. Generally this is met by the weight of the calf being deducted from the live weight of the animal, and in some cases a claim of up to £3 has to be met.

This system is in vogue in Cornwall at the present time and appears to give satisfaction to all parties. It has not been found to drive butchers and dealers to other markets for their supplies of fat stock. The system has, moreover, proved to be a great boon to a large number of young butchers, many of them ex-Service men of no great experience. The more experienced butchers now raise no objection, although they admit the other system suited them best, as they are now no longer able to get the "snips" which their experience enabled them to obtain on some occasions in former days. The auctioneers state that the disadvantage from their point of view is that the system involves more clerical work, but this is now much simplified by the use of ready reckoners.

The farmers are well satisfied with the scheme and feel they are now paid in full for their cattle, and it has a tendency to make them send their cattle to market in better condition. They see exactly what the butcher is prepared to pay per cwt. for well-finished cattle, compared with poorly fed beasts of inferior quality. The system could with advantage be adopted in other districts of the country.

A well-known Cornish farmer observed: "The selling by live weight is one of the best things the farmer has had for years, and selling cattle per head is dead for ever as far as Cornwall is concerned."

A great number of fat pigs are also sold by live weight in Cornwall, but not in the markets. The usual procedure is for the farmer to offer his pigs to buyers attending markets at a price per score lb. live weight delivered at the nearest railway station, and the pigs are then weighed at the station before being put on rail. This system is much in favour, as to send pigs to market entails men's time, horses and waggons, and also market tolls and other expenses, which are to a great extent avoided by delivering direct to a station, probably at a time when cake or manures have to be taken home.

Sheep are not sold by live weight but are often sold at so much per lb. dead weight. the seller to be present when the carcasses are weighed.

## THE WEATHER AND THE FARMER.

THE farmer is doubly interested in the weather. He needs to know, for as long beforehand as possible, what the weather is going to be; he is concerned, though to a less degree, with what the weather has been. Before almost every farming operation, haymaking, harvesting, ploughing, sowing, spraying, etc., he must exercise his weather wisdom; the progress of his crops will often cause him to consult his weather memory. It is the same with the market gardener and the fruit grower. For these, forecasts of the likelihood of rain at sowing or planting-out time and, particularly, warnings of probable night frosts and following sunshine should be of great benefit. Both in (1) forecasting future weather, and (2) in recording weather that is past, considerable assistance may be obtained from the Meteorological Office.\*

**I. Weather Forecasts.**—A weather forecast is a brief description of the weather which is regarded as probable during the period to which the forecast relates. It is only expected to apply to the district specified when the forecast is issued.

For the purpose of compiling forecasts, observations are taken at the same hour four times daily at a large number of stations and telegraphed to the Meteorological Office. That Office then prepares weather maps embodying the main features of these observations and compiles forecasts accordingly.

**A. Forecasts by Telephone.**—Arrangements have been made for weather forecasts to be distributed each afternoon to telephone exchanges. For this purpose Great Britain has been divided into forty districts, and each exchange will have the forecast appropriate to the area in which it is situated.

The forecasts cover the period from six o'clock on the evening of the day of issue until six o'clock on the evening of the following day. The forecasts are available between five o'clock and midnight each day on demand by telephone and should be of special benefit to farmers and other residents in rural areas.

No charge, apart from any cost of telephoning, is made for these forecasts.

**B. Published Forecasts.**—A map based on observations taken at 6 p.m. is published in some of the London morning newspapers. It is accompanied by a "general inference," that is to say, a general description of probable weather movements,

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\* Communications should be addressed to the Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2.



and by forecasts for different districts of the British Isles ("district forecasts") for the next 30 hours, *i.e.*, until the following midnight. Other newspapers (town and country) usually publish the "general inference" and the "district forecast" but not the map; information necessary for constructing a map is distributed by wireless telegraphy (see paragraph C. 3 immediately below).

C. *Forecasts by Wireless Telegraphy*.\*—1. About 9 a.m., 3 p.m., and 8 p.m. G.M.T. each day "district forecasts" in code are broadcast by wireless telegraphy from London.

2. At 9.15 a.m. and 8 p.m. G.M.T. the "general inference" is sent out in plain language.

Those who possess wireless sets can thus obtain considerably later information than that published in the newspapers. Such up-to-date information is of especial value in the British Isles, where, as is well-known, the progress of the weather, for reasons which will be found explained in any book on the subject, is liable to rapid changes.

3. In addition to the above the Meteorological Office broadcasts in code four times daily the observations recorded one hour previously at 17 British stations. From these observations weather maps can be constructed.

D. *Forecasts by Wireless Telephony*.—A weather forecast for the following 24 hours for the area within a radius of about 50 miles of London is issued from the London station of the British Broadcasting Company at about 7 p.m. and 9.30 p.m. The forecast is followed by a statement of the barometer readings at certain stations. The readings given in the first message are those taken at 1 p.m., and in the second message those taken at 6 p.m. The pressure values given in the message refer to Mean Sea Level, *i.e.*, they are comparable with readings from a mercury barometer after the latter have been corrected, and reduced to sea level.

Forecasts for their respective areas are also issued from the Broadcasting Stations at Birmingham, Manchester, Cardiff, Newcastle and Glasgow. These issues are made at about 6.30 p.m. and 9 p.m.

E. *Forecasts by Telegram*.†—1. *Regular Forecasts*.—Regular

\* Full information as to these wireless messages, with a key to the code used, is to be found in "The Wireless Weather Manual" (M.O.255) (London, H.M. Stationery Office, price 9d.). Full particulars of the coded data messages issued in this and other European countries will be found in "Particulars of Meteorological Reports issued by Wireless Telegraphy," M.O. 252, Price 2s. 6d. Supplements issued from time to time give notice of changes.

† Further particulars which are given in M.O. Form 2450 should be obtained from the Meteorological Office.

forecasts for 24 hours or more in advance are despatched by telegram daily to subscribers. These forecasts are normally issued in the afternoon, to cover the weather of the following day, but forecasts for the same day can be issued in the early morning if desired. For these telegrams a fee of 6d. per week, plus telegraphic costs (calculated on an average of 1s. 3d. per message) is charged.

2. *Spells of Settled Weather*.—Another type of forecast, which is sent by telegram, gives notifications of the setting in of spells of fair settled weather and of their break-up. These telegrams are issued daily. The charge from May to September is 6d. for each forecast, in other months 2s. 6d., in addition to the cost of telegraphy.

Those desirous of obtaining forecasts of either type (1) or (2) above should communicate with the Director of the Meteorological Office, Air Ministry, Kingsway, London, W.C. 2, enclosing a postal order or a cheque to cover the cost of the messages required; in the case of the type (2) a deposit of not less than 7s. 6d. should be sent, any unexpended balance being returned on the conclusion of the service. The shortest address which may be used for the telegrams should be stated.

3. *Special Forecasts*.—The Meteorological Office will send by telegraph forecasts of such conditions as spells of frost, ground frost, etc., at a fee of 2s. 6d. plus cost of telegram.

The observations broadcast in code by wireless telegraphy by the Meteorological Office (see paragraph C.3 above) should be used extensively by amateurs, many of whom may care to take the opportunity of keeping themselves up-to-date with weather movements.

Failing this a study from day to day of the map published in the newspapers together with some knowledge of the methods used by scientific forecasters will give anyone who cares to take a little trouble a useful stock of weather wisdom. And it is hoped that many will take this little trouble, for it is only by such general effort that the science of one generation can become the common knowledge of the next. Considerable assistance is also afforded in this direction by the maps issued with the Daily Weather Report (see below).

It is of great importance, too, that volunteers should be found to undertake the task of comparing general weather with local weather. In various parts of the country there is a great deal of local weather-wisdom, which, owing to the more unsettled conditions of modern life, is in danger of being forgotten. It is to be remembered that the Meteorological Office can only give a



general forecast applicable to the district as a whole and a knowledge of local peculiarities will often enable a local observer to modify the general forecasts accordingly.

NOTE.—The maps issued with the “Daily Weather Report” of the Meteorological Office will be found very useful for checking maps prepared by those interested from the observations sent out by the Meteorological Office. The “Daily Weather Report” is issued in three sections: (1) British Section, (2) International Section, (3) Upper Air Section. The British Section is issued at noon, with “general inference” and “district forecasts.”

The cost, post free, of any one section is 6s. 6d. per quarter, or 13s. for all three sections. The International Section is probably the most useful for the study of weather, but the British Section must be referred to for the data for the British Isles which it gives. Further particulars may be obtained from the Meteorological Office.

The following books, which may be obtained through any book-seller, may be recommended:—

*The Weather Map*, by Sir Napier Shaw. (London, H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 1s. 3d., postage 1d.)

*Meteorology*, by R. G. K. Lempfert, M.A. (London, Methuen, 7s. 6d. net.)

*A Short Course in Elementary Meteorology*, by W. H. Pick, M.A. (London, H.M. Stationery Office, 1s. 6d., postage 2d.)

*Forecasting Weather*, by Sir Napier Shaw, F.R.S., Sc.D. (London, Constable. New Edition in preparation.)

The Weekly and Monthly Weather Reports (see below) will also be useful.

*A Meteorological Glossary*. (London, H.M. Stationery Office, 1s., postage 2½d.)

**II. Weather Records.**—A. *Records for Long Periods.*—Climate and soil are of chief importance in deciding what crops to grow. Climate summarises the weather of any particular locality and its variations.\* When the weather has been observed for a sufficiently long time, we are able to obtain valuable particulars of the average temperature, rainfall, etc., at different times of the year at each place, besides (what is also very important) knowing whether the climate is equable or fickle.

There is still much to be done in determining what sort of climate best suits each crop. It is known, for instance, that, generally speaking, the climate of eastern England is better suited to wheat than is that of the west. But certain varieties might be found to stand the western climate better than others; and where a crop is found to be unsatisfactory in a

\* See the article on “Climate” in the *Meteorological Glossary*. (London, H.M. Stationery Office, price 1s.)

district, it may be profitable to cultivate a variety more suited to the climate. Again, there are certain critical periods in the growth of most plants; and where unfavourable conditions often prevail just at a critical period, it might be advisable to select varieties of which the critical period falls earlier or later. Tables showing the average rainfall, temperature, etc., at different times of the year are published by the Meteorological Office. With a knowledge of the requirements of the crops and live stock, a farmer moving to a new district, or trying a new crop, such as sugar beet, in a familiar district, could by studying these records, form some opinion as to how far he is likely to be successful.

NOTE.—The averages are published in the “Book of Normals.” Section I of the “Book of Normals” gives monthly averages of Temperature, Rainfall and Sunshine for over 200 British stations. Section II gives weekly, monthly, quarterly and seasonal averages for the twelve weather districts of the British Isles. Section III contains coloured maps, based on Section I, showing average monthly temperature (highest day and lowest night) rainfall and sunshine. Section IV (in the press) will give for selected stations the temperatures in greater detail, and also the frequency of days of gale, frost, snow, snow-lying and hail. The latter tables should be of value in questions of agricultural insurance. Sections I, II and III are obtainable from H.M. Stationery Office, price 2s., 9d. and 1s. 6d. respectively.

B. *Current Records*.—As mentioned above, much more information is still wanted as to the climatic requirements of each crop, and also as to the effect of the weather at any given period. The weekly and monthly records of the weather will show what have been the outstanding features in successive weeks or months. It will not always do to say that a spell of unusual weather has necessarily been the cause of a large or small crop; the connection between the two is a subject of research, to be undertaken by Research Institutes, Agricultural Colleges and similar Institutions. Vague statements concerning the weather are apt to be misleading, and the appearance of the growing crop is not the sole guide to the ultimate yield. But by carefully watching weather records, and the changes in the growing crops, farmers should obtain much valuable knowledge of the effect of unusual rain or warmth, etc. By keeping such records themselves, and afterwards measuring the yields of their crops, farmers will in time not only learn which weather conditions are really favourable or the reverse on their own soil, but will assist in solving the general problem of each plant's likes and dislikes.\*

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\* For an outline of the more scientific aspect of the influence of weather on crops see this *Journal* for August, 1922, p. 432.



NOTE.—The Weekly Weather Report gives details of weather (warmth, rainfall and sunshine at over 20 stations) for the past week ; notes on the wind, and also a summary of the weather for the week, and for the season and year in progress, as compared with the normal weather.

The Monthly Weather Report summarises weather records from some 300 stations and publishes five charts (wind, movements of depressions—*i.e.*, regions of low barometric pressure, temperature, sunshine and rainfall).

The Annual Summary does much the same for the year.

The Annual Subscription to the Weekly Weather Report, including Introduction and Guide to the Tables, is £2, post free.

The Annual Subscription to the Monthly Weather Report, including the Introduction and Annual Summary, is 10s., post free.

Specimen copies of the Daily, Weekly and Monthly reports may be obtained free from the Meteorological Office.

NOTE.—Orders should be made out as follows :—

*Daily Weather Report.*—To the Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2, remittances being made payable to the “Deputy Secretary, Air Ministry,” and crossed “Bank of England A/c of Paymaster General.”

*Weekly Weather Report and Monthly Weather Report.*—To the Director of Publications, H.M. Stationery Office, at any of the following addresses :—

Imperial House, Kingsway, London, W.C.2 ;  
28, Abingdon Street, London, S.W.1 ;  
York Street, Manchester ;  
1, St. Andrew's Crescent, Cardiff ;  
120, George Street, Edinburgh ;

remittances being made payable to “The Director of Publications” and crossed “Bank of England A/c of Paymaster General, H.M. Stationery Office.”

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## ALSIKE CLOVER.

PROFESSOR R. G. STAPLEDON, M.A.,  
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ALSIKE clover (*Trifolium hybridum*) derives its common name from the fact that it was first introduced into this country from the village of Alsike in Sweden. Unlike red clover and white clover it is not indigenous to Britain, but is native to temperate Europe and occurs also in Asia and Algeria ; it is not common in Southern Europe. The specific name of *hybridum* was given to it by Linnaeus who erroneously regarded it as a hybrid between red clover and white clover.

**Description of the Plant** (see Plate I).—Alsike clover is a perennial plant, although in this country it does not usually persist in quantity for more than from three to five years. In manner

of growth it comes nearer to late-flowering red clover than to broad red clover.

It can readily be distinguished from all forms of red clover by the fact that the plant is quite devoid of hairs. The leaves are slightly toothed and the flower head, which is usually pale pink is borne on a fairly long stalk. The stipule at the base of the leaf stalk is quite different from that of red clover; in the case of red clover the stipule is attached to the stem of the leaf for the greater part of its (the stipule's) length, and ends in a bristle-like point; the stipule of Alsike clover is not joined to the stem of the leaf in the same way and gradually tapers to a fairly long point.

Alsike clover is rather more surface-rooting than the red clovers, but if adult plants of the two species are compared it will usually be found that Alsike clover has produced the greater mass of roots.

Alsike clover is variable but not to the same extent as red clover, and there is certainly not so much diversity amongst the cultivated forms as with red clover.

**Description of the Seed and Impurities** (see Plate II).—The seeds of Alsike clover, like those of white clover, are heart-shaped, but plump, the seeds of the two species being about the same size. Alsike gives about 715,000 and white about 760,000 seeds to the pound. The seeds of both species are smaller than those of red clover which gives 230,000 to 279,000 seeds to the pound. The seeds of Alsike clover are usually of various shades of green deepening almost to blue or black, the seeds frequently having a somewhat marbled appearance. Good samples should be bright with a nice colour range—older and poorly harvested samples usually assume a uniform brown or reddish brown colour.

Alsike clover is grown for seed in this country, but not to the same extent as red clover, most of the seed on the market being imported, chiefly from North America and from the Continent. Home-grown seed and that from America does not frequently contain dodder, but samples from Europe are often contaminated with the seeds of this parasite.

Samples of Alsike clover are liable to contain as much impurity as red clover and sometimes more. The chief weed impurities met with are Sheep's Sorrel (*Rumex Acetosella*), Self Heal (*Prunella vulgaris*), Campion (*Lychnis* and *Silene* spp.), Soft Cranesbill (*Geranium molle* and *pusillum*), Rib Grass



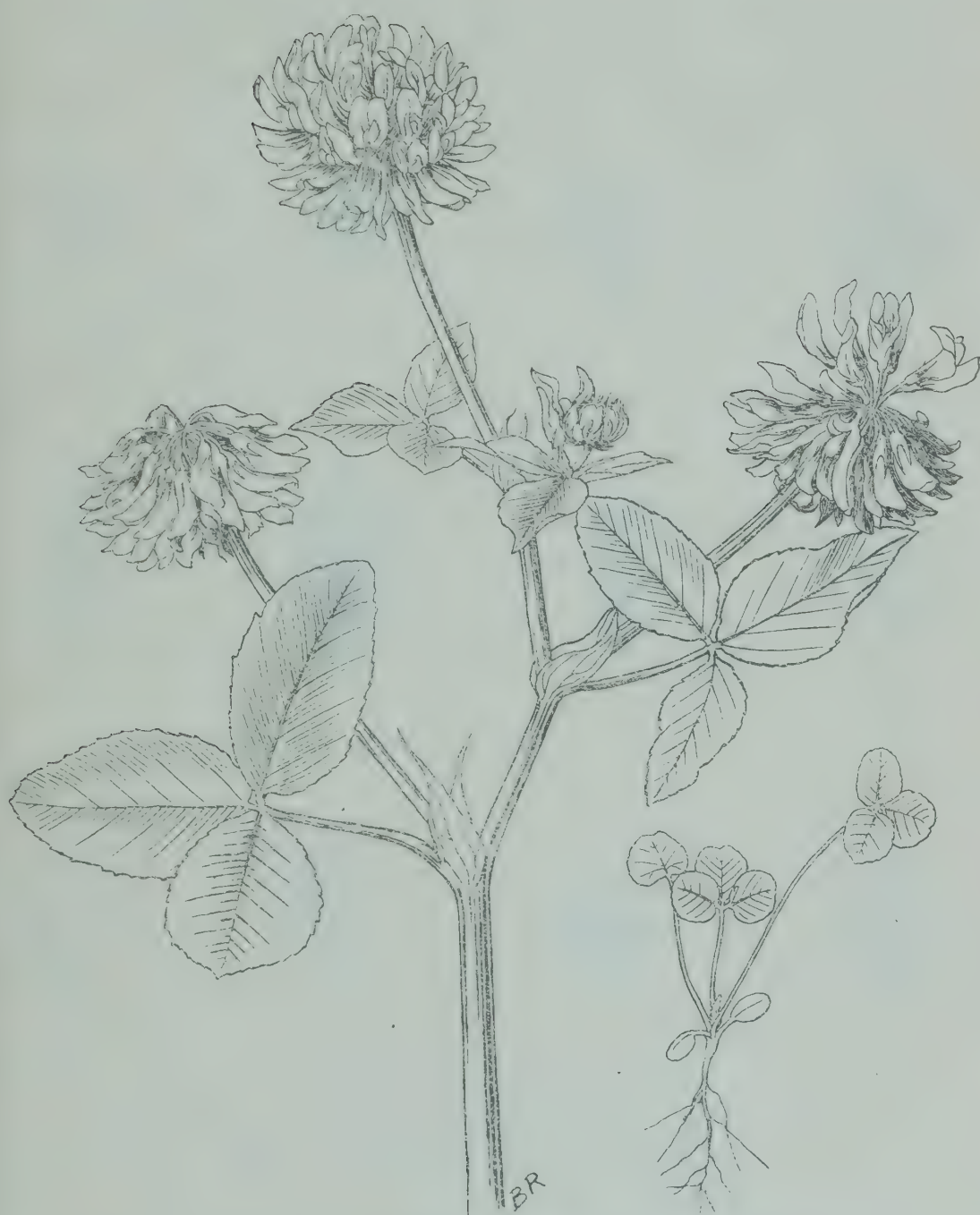


PLATE 1.—Alsike Clover (*Trifolium hybridum*) in Flower (natural size)  
and Seedling.

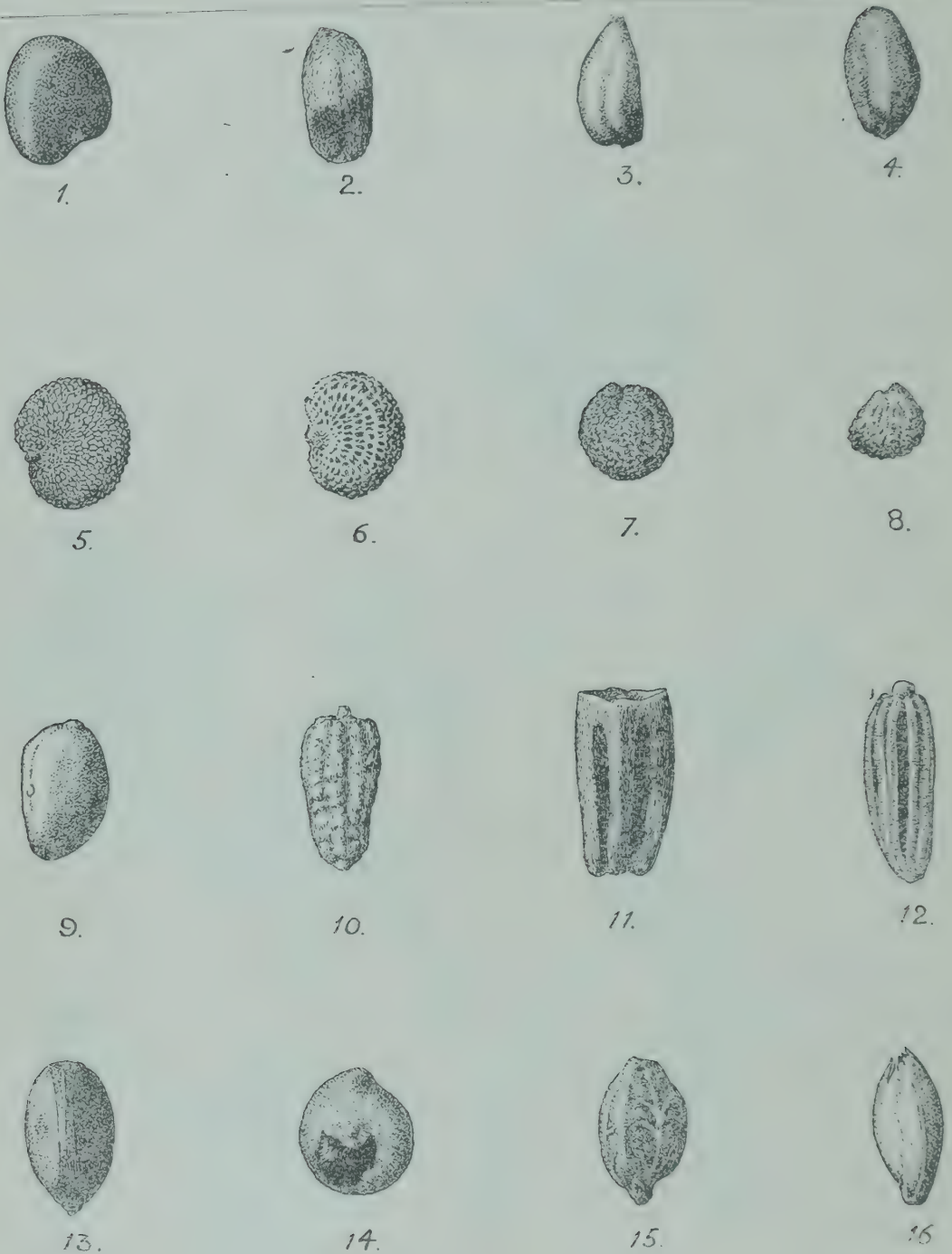


PLATE 2.—Seeds in Alsike Clover Samples, all  $\times 10$ .

1. Alsike Clover (*Trifolium hybridum*).
2. Tumbling Mustard (*Sisymbrium altissimum*).
3. Treacle Mustard (*Erysimum cheiranthoides*).
4. Small-seeded False Flax (*Camelina microcarpa*).
5. Night-flowering Catchfly (*Silene noctiflora*).
6. White Campion (*Lychnis alba*).
7. Common Chickweed (*Stellaria media*).
8. Mouse-ear Chickweed (*Cerastium vulgatum*).
9. Dove's Foot Cranesbill (*Geranium molle*).
10. Stinking Mayweed (*Anthemis Cotula*).
11. Scentless Mayweed (*Matricaria inodora*).
12. Ox-eye Daisy (*Chrysanthemum Leucanthemum*).
13. Self-heal (*Prunella vulgaris*).
14. Fat Hen (*Chenopodium album*).
15. Sheep-sorrel (*Rumex Acetosella*).
16. Timothy grass (*Phleum pratense*).



(*Plantago lanceolata*), and Mayweeds (*Anthemis* and *Matricaria* spp.).

Timothy, trefoil and white clover are frequent and sometimes abundant impurities of Alsike.

**Agricultural Uses.**—Alsike clover is not used to a very great extent in rotations; it is, however, considerably less susceptible to both eelworm disease and stem rot (*Sclerotinia trifoliorum*) than red clover; consequently in cases where clover leys are deemed to be essential even on "sick" land Alsike is to be preferred to red clover. When sown alone the usual seeding is about 8 to 12 lb. per acre. Pure Alsike or leys where Alsike predominates must be both grazed and fed green to stock with even greater care than red clover, particularly when it is in the flowering stage.

Alsike clover can be grown successfully under a wider range of soil and climatic conditions than can red clover; it withstands both acid conditions and excessive wet remarkably well and is considerably more winter-hardy than many strains of red clover. It can be grown to advantage under irrigation. Alsike clover is, therefore, a most valuable plant for use in seeds mixtures for leys on wet and waterlogged soil and, generally, for both rotations and longer leys at high elevations and in regions of high rainfall. In wet climates it has the further advantage that it may be cut for hay over a longer period than red clover. It should be included in seeds mixtures whenever there is any risk of a failure of "take" from the red clover, and thus on wet soils and in wet districts a few pounds of Alsike added to the red clover for even a one year ley would be in the nature of an insurance. Alsike and Timothy make a good combination for short duration leys on wet and heavy soils, while recently Alsike and cocksfoot have proved a successful combination on more normal soils. When Alsike is the only clover used for a short duration ley, from 5 to 7 lb. per acre should be employed. In more complicated mixtures for longer duration leys the amount usually varies from 1½ to 2½ lb. per acre. It has been remarked that Alsike Clover has rather a similar growth habit to late-flowering red clover; these clovers are therefore to some extent mutually incompatible and are not both likely to do themselves justice when sown in large amounts in the same mixture. If and when late-flowering red clover is chiefly desired it is wisest only to include about 1 lb. of Alsike with 3 to 3½ lb. per acre of late-flowering red clover. This amount of Alsike will ensure some stand of clover if for

any reason the late-flowering red fails, without seriously hampering the development of the latter if a good "take" results.

The source of origin of the seed in relation to crop production does not appear to be of as great importance in the case of Alsike as of red clover, but this is a matter demanding further investigation.

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## IMPROVEMENT OF POOR GRASS LAND IN EAST SUFFOLK.

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THERE is in East Suffolk poor grass land of the following quite distinct types, and, as far as possible, experimental plots have been laid down on all of them:—

(i) *Poor Heavy Land Grass*.—Probably a larger area of this exists than of any other type. Much of it is covered with thorns and the general tendency of this type of land is to grow whitethorn, unless it receives constant attention.

(ii) *Poor Mixed Soil Grass*.—There is not such a great area of this, as mixed soil is generally under tillage, for which purpose it is, under the climatic conditions of East Suffolk, much more suitable than for grass.

(iii) *Poor Light Land Grass*.—Much of this is hardly worthy of the name of grass land, as it produces practically nothing and may almost be described as derelict.

(iv) *The Marshes*, situated on the banks of the rivers, and near the sea. These vary much in type and are quite a distinctive feature of the grass land of the county.

Experimental plots on these various types of grass land may be considered in the above order.

1. **Poor Heavy Land**.—*Experiments at Saxmundham (Rendham) Experimental Station*.—The soil is a poor thin-skinned boulder clay. The field in which these experiments are conducted was nearly derelict twenty years ago, when taken over by the County Council. At the present time a field within twenty yards of the experimental field is still covered with bushes. Table I gives the manurial dressings applied and the yields of hay from the experimental plots.

Of special interest at the present time are Plots 3, 5, 6 and 7, which have received comparatively heavy dressings of superphosphate several times and which still maintain their yield. This shows that should it be proved that basic slag becomes shorter in quantity and inferior in quality in the future, heavy



land farmers in East Suffolk may rely upon getting good results on their pastures from superphosphate, provided that their land contains sufficient lime.

TABLE. I—*Poor Heavy Meadow Land (Saxmundham).*

Each plot  $\frac{1}{4}$  acre except Plots 1A, 1B, 2A and 2B, which are  $\frac{1}{8}$  acre.

	<i>Treatment.</i> (The dates given are those on which the manurial dressing was applied).	<i>Yields of Hay.</i>				Average 1902-1922 (grazed 1908). cwt.
		1919.	1920.	1921.	1922.	
		cwt.	cwt.	cwt.	cwt.	
1A.	10 cwt. basic slag, 1901, 1907, 1912, 1915-16, 1919-20 ...	14.2	21.5	16.5	25	24.6
1B.	10 cwt. basic slag, 1901, 1907, 1912, 1915-16, 1919-20, 2 cwt. kainit, 1909, 1912, 1915-16, 1919-20 ...	15.5	26	18	27	26
2A.	5 cwt. basic slag, 1901, 1904, 1907, 1912, 1915-16, 1919-20 2 cwt. kainit, 1909, 1912, 1915-16, 1919-20 ...	14	25	19	24.5	21.6
2B.	5 cwt. basic slag, 1901, 1904, 1907, 1912, 1915-16, 1919-20 2 cwt. kainit and 1 cwt. nitrate, 1909, 1912, 1915-16, 1919-20	14.6	26.5	16.5	24.5	22.8
3.	7 cwt. superphosphate, 1901, 1904, 1907, 1912, 1915-16, 1919-20 ...	14	23	18	23.75	22.5
4.	Unmanured ...	8	10.75	10.5	11.5	9.8
5.	7 cwt. superphosphate, 3½ cwt. kainit { 1901 1904 1907 1912 1915-16 1919-20	14.6	29.5	18	25	24.3
6.	7 cwt. superphosphate, 10 cwt. lime { 1901 1904 1907 1912 1915-16 1919-20	14.5	28.5	13.5	22.75	23.5
7.	7 cwt. superphosphate, 71 lb. sulphate of ammonia { 1901 1904 1907 1912 1915-16 1919-20	15	29.5	14	27	25.4
8.	6 cwt. dissolved bone in { 1901 1904 1907 1914 3½ cwt. bone meal in { 1915-16 1919-20	13.4	24.25	13	22.5	21

NOTE.—1915-16, 1919-20 means the winter of 1915-1916, 1919-20.

*Sheep Grazing Plots at Saxmundham (now arable).*—Part of the area was manured with 10 cwt. of basic slag in 1904 and again in 1912, and the whole was grazed with sheep. The manured portion gave a profit, after paying for the manure, of 17s. 2d. per acre per annum over the period of years.

The land was ploughed up from grass and the following crops obtained per acre. The object of this experiment was to ascertain the improvement in the crops (if any) due to the residual effect of the basic slag upon the fertility of the soil:—

	1919. <i>Mixed Beans and Peas.</i>	1920. <i>Wheat.</i>	1921.. <i>Barley.</i>	1922. <i>Mangolds.</i>
Plot 1. No manure	29·7 bus. corn.	29½ bus. corn.	31½ bus.	23 t. 15 cwt.
on grass	42 cwt. straw.	35 cwt. straw.	—	—
Plot 2. 10 cwt. basic	40 bus. corn.	38·8 bus. corn.	43½ bus.	26 t. 10 cwt.
slag in 1904 and	62 cwt. straw.	45 cwt. straw.	—	—
again in 1912				

The continued superiority of the slagged over the unslagged plot is undoubtedly due to wild white clover, which grew most luxuriantly on the slagged plot for years before it was ploughed up.

*Park Farm, Shadingfield (Mr. G. Mitchell).*—The field chosen adjoins the railway from Brampton to Beccles. The land was covered with thorns, the bushes being 10 to 12 ft. high, until the spring of 1920, when they were removed, and manures applied in March, 1920.

The following are observations on the plots made as a result of several inspections:—

*Plot.*

1. No manure.—Very poor.
2. 800 lb. 28 per cent. basic slag (containing 100 lb. phosphoric acid).—This has been a very good plot. The basic slag caused a great growth of wild white clover, with the consequence that the cattle have grazed it very closely.
3. 800 lb. 28 per cent basic slag (containing 100 lb. phosphoric acid), 224 lb. kainit.—Very good; similar to Plot 2. It is doubtful whether the additional application of kainit paid.
4. 370 lb. ground Algerian phosphate (containing 100 lb. phosphoric acid).—This plot is slightly better than the “No manure” plot, but is very inferior to Nos. 2, 3 and 5.
5. 728 lb. 30 per cent. superphosphate (containing 100 lb. phosphoric acid).—Very good; equal to Nos. 2 and 3. The effects of the superphosphate on this plot were visible in the season 1920, *i.e.*, before the other manures had been given time to act.

When inspected on 7th May, 1923. Plots 2, 3 and 5 were still much better than Plots 1 and 4. Much more white clover was present, and it was also very interesting to observe that there





FIG. 1.—Shadingfield Plots. *Left*, No Manure ; *Right*, 800 lb. Basic Slag (100 lb.  $P_2O_5$ ).  
The white flowers are daisies, not White Clover, which will come on later.



FIG. 2.—Showing the Rough, Marshy Grassland at Scots Hall, Westleton.





were far more daisies in flower on these plots on the day of inspection.

This soil contains chalk stones. Half of each plot was dressed with one ton of lime per acre, but this has not had much effect.

*Marsh Farm, Ellbough, Beccles (Mr. Wm. Bullard).*—The soil is poor heavy land. On 15th March, 1920, the same manures were applied as at Shadingfield, but they have not given such a good return up to the present as at that centre. During the autumn of 1922 the following observations were made:—

*Plot.*

1. No manure.—Poor and weedy.
2. 800 lb. basic slag (100 lb. phosphoric acid).—Clover, better grazed.
3. 800 lb. basic slag (100 lb. phosphoric acid), 224 lb. kainit.—A good deal of clover present, well grazed.
4. 370 lb. ground Algerian phosphate (100 lb. phosphoric acid).—Weedy.
5. 728 lb. 30 per cent. superphosphate (100 lb. phosphoric acid).—Much clover present, well grazed.

These plots were ploughed up during the winter, 1922-3, and the field sown with linseed in the spring of 1923.

*Little Glemham, Saxmundham (A series of trials conducted at Mr. Kirkwood's expense).*—Soil part heavy and part lighter. Mr. Kirkwood applied 7 cwt. per acre of 30 per cent. basic slag to certain parts of the Park in December, 1920; in other parts a similar dressing was applied of material known as slag phosphate, whilst small areas in various parts were untreated. When inspected by a party of farmers in June, 1922, part was being grazed, and part was intended for mowing. After a careful examination of the herbage in the grazed part, it was considered that the best pasture was found on the portion manured with slag in 1920. This contained a very large proportion of wild white clover. Compared with the unmanured part it was thought that the slag phosphate had done some good, but not so much as the basic slag.

The area reserved for hay was then examined, and it was found that where the basic slag had been applied in 1920 the crop was at least doubled and was of vastly better quality as compared with the "no manure" plot. Even basic slag applied in December, 1921, had already made a considerable improvement. The party were able to pick out the unmanured patches which had been left here and there, in most cases to within a yard, and the whole inspection formed an

object lesson in the extraordinary improvement caused by the application of basic slag to suitable land.

Lastly, a small area was inspected, which had received a dressing of farmyard manure, followed by a dressing of basic slag. This was being reserved for hay, and had produced a very heavy crop of beautiful herbage—in fact, the treatment was considered to be extremely suitable for this type of land when intended for hay, as the farmyard manure encourages the strong growing grasses, and the basic slag encourages the clovers.

**2. Poor Mixed Soil.**—*Corton County Council Small Holdings Estate (Mr. C. G. Cross).*—Manure applied in the winter of 1921-22.—The object of this test is, first, to ascertain the extent to which grass land of the poor mixed soil type can be improved, and secondly, what kind of dressing is likely to prove most successful. As regards the first point it was found that on all the manured plots a much larger proportion of clover was present. It seemed probable that the best plots were worth at least twice as much per acre, as far as actual feeding value was concerned, as were the unmanured plots.

As regards the effect of the various dressings applied, it might be explained that the dressings used were not heavy. They each contained phosphoric acid equal to 100 lb. per acre (*i.e.*, as much as is contained in 5 cwt. of high-grade basic slag). Four different kinds of basic slag were used—modern medium quality 24 per cent. slag, high-grade high-soluble Bessemer slag, open hearth high-soluble slag, and open hearth low-soluble slag. There were also included in the tests superphosphate, Gafsa (North African) rock phosphate, Nauru phosphate and the so-called “slag phosphate” which is a mixture of low quality basic slag and Nauru phosphate.

A careful examination of the plots in the autumn of 1922 showed that all the manures had done some good. It was observed, however, that all the plots receiving superphosphate and the highly soluble slags had been more closely grazed by the stock than others. On these plots, in fact, there was a carpet of white and red clover, quite close to the ground, and hardly any of the coarse and unpalatable grass, which was such a feature of the “no manure” plots.

It is just possible that this close grazing was partly accidental, but on the whole it seems probable that the more soluble manures had acted more quickly, and these plots had showed an improvement first. The cattle grazing the field would



quickly find this out, and would go for the sweeter plots, with the result that the coarse grasses would tend to disappear by the closer grazing. Many of the other plots had shown considerable improvement over the "no manure" plots, but they had not been quite so closely grazed. A further inspection in the spring, 1923, showed that the herbage on the "no manure" plots is strikingly inferior to the rest of the field.

3. **Light Mixed Soil.**—*Woodbridge (Mr. G. Barnardiston).*—Mr. Barnardiston very kindly offered to conduct at his own cost a series of plots on a field adjoining his house at Woodbridge. Basic slag alone, basic slag with kainit, superphosphate alone, superphosphate with kainit, and North African phosphate were tried. Each plot received manure costing £1 13s. 9d. per acre in the winter of 1921-22.

The land is of a difficult type on which to encourage the growth of wild white clover, especially with such weather conditions as prevailed in the early months of 1922. When inspected in June, none of the plots showed much evidence of improvement. It is worthy of note that the improvement of pasture land almost entirely depends on the growth of wild white clover, and this can only take place providing sufficient moisture is present. For this reason the improvement of grass on light mixed soil is a difficult matter.

4. **Marshland.**—*Scots Hall, Westleton (Mr. J. W. Rickeard).*—Manures sown November, 1921. The marshes are adjoining the sea. In each case the manures were arranged to cost £1 13s. 9d. per acre at the time of sowing.

*Plot.*

1.  $11\frac{1}{4}$  cwt. basic slag (92 lb. phosphoric acid).
2.  $6\frac{3}{4}$  cwt. basic slag (55 lb. phosphoric acid),  $3\frac{3}{4}$  cwt. kainit.
3.  $7\frac{1}{2}$  cwt. superphosphate (115 lb. phosphoric acid).
4.  $4\frac{1}{2}$  cwt. superphosphate (69 lb. phosphoric acid),  $3\frac{3}{4}$  cwt. kainit.
5. 363 lb. Nauru phosphate (137 lb. phosphoric acid).
6.  $4\frac{1}{2}$  cwt. slag phosphate (115 lb. phosphoric acid).

The marsh was covered with small rushes and is rather wet. During the summer of 1922, a great improvement was to be seen on some of the plots, and large quantities of wild white clover and wild red clover grew up amongst the rushes to a height of several inches.

After a rather prolonged examination of the plots, the party of inspection during the summer came to the conclusion that Plot No. 1 was the best. This plot showed a great improvement over the adjoining land which was unmanured. The wild white

clover and wild red clover were growing up amongst the inferior herbage in a most encouraging manner and the weight of the crop on this plot was estimated to be double that on the "no manure" plot.

The second best plot was thought to be No. 3, which received  $7\frac{1}{2}$  cwt. of 30 per cent. superphosphate. This plot also contained a large proportion of white and red clover, and showed that should our sources of basic slag fail us, superphosphate would answer extremely well, on even such unpromising places as the marshes. The third and fourth plots in order of merit, as judged by appearances, were No. 2 and No. 4. Plots 5 and 6 were distinctly better than the "no manure" plot.

*Sanders Hill Marsh, Scots Hall, Westleton.*—The manuring per acre was as follows:—

*Plot.*

1.  $11\frac{1}{4}$  cwt. basic slag.
2.  $6\frac{3}{4}$  cwt. basic slag and  $3\frac{3}{4}$  cwt. kainit.
3.  $7\frac{1}{2}$  cwt. superphosphate.
4. No manure.
5.  $4\frac{1}{2}$  cwt. superphosphate and  $3\frac{3}{4}$  cwt. kainit.
6. 363 lb. Nauru phosphate.
7.  $4\frac{1}{2}$  cwt. slag phosphate.

The grazing marsh was selected because of the extreme coarseness of the herbage, which consists largely of sedges, rushes, and wild iris, growing 2 ft. or so in length. A careful examination in June, 1922, however, revealed the presence of wild white clover, with large leaves at the end of long leaf stalks which had grown to an unusual height in order to enable the leaves to reach the light. The various manures given above had been applied to this most unpromising herbage, and it was thought that both the basic slag and superphosphate had made some improvement. It was considered, however, that the wild white clover had not a chance to develop properly owing to the heavy top-growth. Mr. Rickeard now proposes to keep the top-growth cut off. When inspected at the end of November, 1922, the whole had been cut and grazed quite closely. These plots should prove very interesting during the coming season.

*Marshes, Hall Farm, Rushmere, Lowestoft (Mr. John Oldrin).*—This marsh land is on the banks of the Hundred River. The soil is a sandy peat evidently containing a large proportion of vegetable matter. At present a considerable proportion of the herbage consists of rushes, and Mr. Oldrin has been trying the interesting experiment of running a plough, with



a wide share, with a special wing attached, to cut 14 in. wide under the turf. The breast is removed from the plough and the turf is allowed to fall back to the place from which it was cut, and is then rolled down. A careful examination by a party of farmers in July, 1922, of the strips treated in this way showed that they contained a considerably smaller proportion of rushes, even when three years had elapsed since the treatment. In the case of land similarly treated in the autumn of 1921 it appeared that the bulk of the herbage was slightly reduced but the quality was improved. The strips of land were cross-dressed with various manures so that it was possible to observe the effect of the manures both on the ploughed and unploughed portions.

It had been arranged that each manured plot should receive manure costing £1 13s. 9d. per acre. The manure was not applied until March, 1922, so that the slower-acting manures had not had time to act. A careful examination of the herbage led to the conclusion that all the manures had done some good, when compared with the "no manure" plot. In all probability the two best plots were No. 3 receiving  $7\frac{1}{2}$  cwt. 30 per cent. superphosphate per acre, and No. 5 receiving  $4\frac{1}{2}$  cwt. 30 per cent. superphosphate and  $3\frac{3}{4}$  cwt. of kainit per acre. Most members of the party considered that No. 5 was slightly the better. Certainly the weight and quality of the herbage on these two plots had been very considerably increased. Of the remaining plots, No. 1 which received  $11\frac{1}{4}$  cwt. 16 per cent. basic slag, and No. 2 which received  $6\frac{3}{4}$  cwt. 16 per cent. basic slag and  $3\frac{3}{4}$  cwt. kainit per acre were decidedly better than the "no manure" plot although, having been applied in the spring, the basic slag had not had time to act properly. Plots No. 6 which received 363 lb. of Nauru phosphate and No. 7 which received  $4\frac{1}{2}$  cwt. slag phosphate per acre, were also considered better than the "no manure" plot, although the dressings also had not had time to act. The plots should be very interesting in 1923 and 1924.

On the whole it would appear that much improvement of marsh land of this type can be effected by the application of superphosphate or basic slag, and that clover can be encouraged to grow in a really surprising manner by the use of these manures. In the case of sandy peat, it may pay to add some kainit, sylvinit or other potash manure to the phosphatic manure, but that is a matter to be tested in each case.

*Marshland at Trimley (Mr. C. C. Smith).*—These marshes differ from many Suffolk marshes in that the soil is covered by a thick mat of undecayed vegetable matter. In some places this mat is two or three inches thick, and it is only soaked by rain with great difficulty. About ten years ago a number of plots were laid out by Mr. Smith at his own expense on the two marshes. The manures used included farmyard manure, basic slag alone and in combination with muriate of potash, superphosphate alone and in combination with muriate of potash and ground lime. Ground lime was also used alone.

On the first marsh some improvement was evident where the phosphatic manures were applied. None of the manures succeeded in getting rid of the thick mat of vegetable matter, although they encouraged the growth of clover to some extent. On the far marsh where the mat of vegetable matter is very thick, the improvement was not so great as on the first marsh.

The problem of getting rid of the thick mat of vegetable matter is, therefore, at present unsolved, and Mr. Smith proposes to try other methods and applications in order to see whether it is possible to effect a greater improvement in these marshes.

Dr. J. A. Hanley, of Leeds University, who inspected these marshes in June, 1922, thinks that a dressing of crag or chalk, would greatly benefit them, as the thick mat of vegetable matter is, in his opinion, due to lack of lime.

*Lyons Farm, Bulcamp (Mr. W. C. Mitchell, Agent).*—The cost of this experiment was borne by the Earl of Stradbroke. The soil is black, containing much vegetable matter, the herbage being largely rushes. The original experiment was started on the marsh near Bulcamp Workhouse in March, 1920.

The following observations were made after an inspection by farmers in June, 1922 :—

*Plot.*

1. No manure.—Very poor, and full of rushes.
2. 800 lb. 28 per cent. basic slag (100 lb. phosphoric acid).—A great improvement; much clover present.
3. 800 lb. 28 per cent. basic slag, 224 lb. kainit.—A great improvement; much clover present.
4. 728 lb. 30 per cent. superphosphate (100 lb. phosphoric acid).—A great improvement; much clover present. This plot showed improvement first.
5. 370 lb. ground rock phosphate.—Very little better than the “no manure” plot in 1921. Improved in 1922.



The plots were cross-dressed with 1 ton of lime per acre, but this has not done much good up to the present.

A meeting of farmers was held on these plots in 1921, and they considered the results extremely interesting, and at their request a further experiment was arranged on an adjoining marsh, the manure being applied during the winter 1921-22. This second series of plots was inspected in June, 1922, when it was found that some of them contained a perfect carpet of white clover several inches deep. The best plots were those receiving basic slag, basic slag and kainit, superphosphate, and superphosphate with kainit. All this latter series of plots received 150 lb. of phosphoric acid per acre. These plots should prove an interesting study for some years.

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## THE HILL SHEEP FARMS OF NORTHUMBERLAND.

J. ROBSON.

THESE farms occupy practically all the land lying between 500 ft. above sea level and the top of Cheviot, which stands at 2,676 ft. All kinds of weather are met with. An old saying is: "Little kens the guid wife of the trows how the wind blaws on Windy Gill." If there is such a variety of weather on one farm, one can understand the changes which are encountered between the Durham boundary and the North Sea. A variety of herbage is met with, heather, flow and bent predominating south of the North Tyne, but further north finer grasses are sometimes found. As I am not a botanist, I cannot describe all the plants which comprise a good hill pasture, but the more it is mixed, the better it is counted. The deeper the soil, the bigger the sheep it will produce; and there must be a certain amount of fine grass along the burn sides to make big fat lambs.

There ought also to be a small proportion of heather to provide a change of meat and a healthful tonic, also some flow ground on which the draw-moss (*Eriophorum vaginatum*, L.) and deer's-hair (*Eleocharis caespitosa*, Link) grow. If the "Flows" lie fairly low so that stock are not prevented grazing on them in stormy weather, their situation is ideal. There can be too much of a good thing, and though too much mowing makes for waste land, a little is invaluable.

In a really bad spring stool bent (*Juncus squarrosus*, L.) is often

the only green thing that can be found, and a little of it comes in very useful for the flock. However, it is generally found on hard, bare land, and too much is not desirable.

White Bent (*Molinia cærulea*) is unfortunately too common. Its life as a food is so short that it is only available for sheep for about three months. Thus one scarcely ever sees it on a good farm. It is greatly benefited, and its useful life prolonged, through heavy eating by cattle, but as it can only be stocked with them in June, and they should be away by September, it is scarcely a profitable business buying them for that short period, especially as that is the time when grass everywhere is generally most plentiful.

**Breeds.**—Only two breeds of sheep are found, the Cheviot, indigenous to the district, and the Blackface. The former was thought so much of that in 1703, Sir John Sinclair, when taking sheep to the North of Scotland, came to Northumberland for a selection. A century ago, Blackfaces were unknown in the county, but with the demand for younger mutton, and the low price of wool combined with a run of bad seasons, this breed began to replace the Cheviot, till now they are perhaps as numerous.

**Stocking.**—The farms range from 500 to 10,000 acres with a sheep stock of 100 to over 3,000. On an average a shepherd will have a “hirsle” of 600 sheep, and his “hill” will extend to anything from 500 to 2,000 acres. One sheep to the acre is usual on the better land, but as much as three acres per sheep may be required on the poorer grazings.

Formerly shepherds were paid “pack” wages, that is, they were allowed to keep so many sheep, from fifty upwards, along with the employer’s, and the increment from them was his wage, but packs are very scarce now, and the shepherds are generally paid in cash, with a free house, potatoes, coals carried free, and the keep of two cows. The pack system caused a good deal of extra labour in sorting, all the pack sheep having to be sorted by themselves. Of course, this was payment by results, but just as much care is taken one way as the other, and in fact the only shepherd who ever left the writer in the lurch had a pack wage and left his own sheep behind.

**Management.**—The management of the two breeds is practically the same, so one description will do for both. We will take the season as beginning about 20th November, when the tups are put out, one tup to 60 or 70 ewes, and during the



time they are out, about ten weeks, the ewes are gathered to each tup. A few extra tups should always be provided to replace any that go wrong. About the New Year they are brought in, and usually sent away to turnips, unless these are grown on the farm. After that, should the weather be favourable, is the shepherd's easiest time, as less herding is required then than at any other season. The shepherd must always be on the alert in case a sudden snowstorm should arise, when the sheep must be gathered to the stells. This may be a very trying time, as, if the flock be caught out, it is very hard work indeed getting them collected, so much so that some men have become so exhausted that they have succumbed to the exposure.

That sheep farming is not all beer and skittles was proved by the spring of 1917, when in spite of every attention thousands of sheep were lost. The year 1860 was also a disastrous one; on one of the best hill farms in the county only 220 lambs were weaned from 1,400 ewes. The "eighties," also, took a heavy toll from border farmers.

Calamities such as these leave their mark for many years, not only on the bank balances of the stock owners, but also on the stamina of their sheep, for the survivors, though no doubt the strongest, suffer in hardihood.

A bad lambing time, too, by causing a short crop of lambs, compels farmers to retain as breeding stock many smaller and poorer lambs which in the ordinary course would have been drafted.

A snowstorm is a great test of a shepherd's ability, as some men have the knack of looking after their flocks so that they exist much longer without hay than others can. In such seasons the shepherd's work is arduous as well as disappointing, for in spite of all he can do, his charges deteriorate in condition. When hay is required there should be a daily allowance to each score of sheep of about a stone of the best hay scattered on a piece of well-sheltered ground which should be changed as often as possible. On some farms, benty or grassy ones as a rule, once haying is commenced it is continued as long as it is eaten. In this case it is given in hicks or nets, and care should be taken that the sheep are not allowed to lie about the nets after they have eaten up the hay. As the season wears on a sharp look-out must be kept for any lean sheep, and these should be brought into the fields or sent away to better grass. About the beginning of April it is customary on some farms to udderlock

all the ewes as it is thought that the lambs suck more readily and there is less danger of the lambs getting wool in their stomachs.

With such flocks ewes are lambed on the hill, and not brought into enclosures as in other parts. Lambing begins about mid-April, and each shepherd is generally provided with a lambing man whose assistance he has for a month. Before he leaves, the lambs should be marked, their tails cut, and the wedder lambs castrated, those intended for tups having been selected first. Castration can be done in many ways. The oldest and simplest is by the knife, the other of the more commonly practised methods being by the clamps and a hot iron. In the latter case the operation is generally deferred till the end of June and is commonly practised on "diseased" farms. At the end of June sheep are washed by being swum through a pool a few times, but Blackfaces are seldom washed, and many Cheviots are now clipped in the grease. Clipping takes place in July—Cheviots about the beginning, Blackfaces later. This should be carefully done, the wool nicely trimmed and the fleeces neatly tied by ropes made by twisting a piece of the fleece.

On the eastern borders, Cheviot ewe lambs for stock are weaned about the end of July and sent to their hogging where they stay for two years and are then brought to the ewe "hirsels" to take the place of the ewes sold as drafts at five years old. Further west and amongst Blackfaces, the keeping ewe lambs generally follow their mothers and have lambs a year younger—at two years. The wedder lambs are sold at the auction marts at the end of August and are bought by feeders to be fed off. Blackfaces are often sent straight to the butcher, and many who practice this method do not cut their lambs but sell them as tups in August and early September. If kept, they should be cut later.

The summer dipping should be done in August and a fly dip is generally used at this time. Cheviot draft ewes should be dressed and brought out in as good form as possible for the draft ewe sales held early in October. Blackfaces should be dipped in a bloom dip and brushed up, not dressed like Cheviots. As soon as the drafts are away, the second dip should be used. After this, dosing the hogs, if it is practised, is the next work, and we complete our cycle with heeling—marking with a coloured paint, at which period it is advisable to select the best ewes to put to the best tups obtainable.



During the whole year a constant lookout should be kept for lame sheep and any showing the least symptoms of lameness brought in, the feet pared, and dressed with a good paste. After dipping, some flockmasters drive their sheep through a footrot trough containing a mixture of a proprietary article, arsenic, or bluestone; this is a great preventive of footrot, but should not take the place of the foot dressing previously mentioned.

Maggot flies are much more troublesome now than they used to be, and a constant watch should be kept for them. If very bad, dipping the whole flock is advisable, as for a time it keeps the fly off.

If the shepherd takes a real interest in his flock, his duties, though necessarily of a routine character, can never be monotonous, as such work certainly would be to anyone who simply did it for his daily bread. To rise at daybreak, climb to the top of a hill, often rising one thousand feet above his cottage, turn his sheep in, then come back above them again to see that none are left lying back or are amiss in any way, may mean a walk of six to ten miles—determined by the extent of ground which comprises his “hirsell.” His time is then his own—unless he finds some of his flock require special attention—till the afternoon, when he takes a turn round the lower part of his ground, turning his flock out so that they go to the hill tops for the night, except in stormy weather, when they are allowed to lie on the lower and more sheltered parts. A good shepherd should, as we are told, know his sheep, and although I am doubtful if the sheep know him, they certainly know his dogs, as anyone can see who takes strange dogs amongst them.

Shepherds have generally to help at hay time, so that season is a hard one for them, having their sheep to watch and also to be in the hayfield when hay-making is possible.

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## ELECTRO-CULTURE WORK IN 1922 AND 1923.

THE following account of work on electro-culture, carried out in 1922 and to be carried out in 1923, is summarised from the Fifth Interim Report of the Ministry's Electro-culture Committee, which has recently been presented.\* The previous work

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\* This report will not be published, but copies may be obtained on application to the Secretary of the Committee, Mr. W. R. Black, B.Sc., Ministry of Agriculture, 10, Whitehall Place, London, S.W.1.

of this Committee was summarised in this *Journal* for December, 1922, p. 792.

During 1922 field experiments were carried out for the Committee by Prof. V. H. Blackman as follows:—*Rothamsted Experimental Station*—Experiments with winter wheat and barley; *Harper Adams Agricultural College*—Experiments with cabbages, swedes, mangolds and potatoes; *Lincluden*—An experiment with potatoes. An economic installation was erected at Rothamsted. Pot-culture experiments with barley were continued at Rothamsted. Laboratory investigations were conducted at the Imperial College of Science. Electrical measurements were made to determine the influence of an electro-culture installation on the electrical conditions to leeward and windward.

**Field Experiments in 1922.**—Seven experiments were carried out during the year, two with cereals, two with potatoes, two with root crops and one with cabbages; two of these gave a positive result and five a negative result. The season was not a favourable one for experimental purposes, the yields of the cereals being abnormally low, that of wheat being only about half the average. In the case of the root and cabbage crops, owing to the doubt which exists as to the satisfactory nature of the cultural conditions, the Committee are of opinion that no safe conclusions can be drawn from the experiments, and that the results should not be included in future records.

For an account of the field experiments in detail reference must be made to the Committee's Report.

**Pot-Culture Experiments of 1922.**—Ten experiments were carried out with barley in 1922 and were mainly designed to obtain further knowledge as to the stage of plant growth during which the discharge can most advantageously be given, and the most suitable daily duration of the discharge. An experiment was also carried out to determine the effect of the normal atmospheric current. In all the experiments grain yields as well as total yields were obtained.

The discharge was applied (in different experiments) in the first month, the second month, and the third month of the growing season respectively, and also throughout the whole three months; in the case of each period the discharge was applied (in different experiments) for six hours and also for one hour daily.

Definite increases of yield were obtained in all the experiments but one, in which the plants were attacked by mildew. The increases in dry weight reached 39 per cent. in one experiment, but in other cases were quite small. In all cases, however, with



the exception already mentioned, very marked increases in *grain* yield were obtained, reaching even 118 per cent., and these large increases in grain yield were usually associated with very small increases in total yield. The effect is so marked that it establishes a differential action of the discharge—that of accelerating reproductive growth apart from vegetative growth, an effect hitherto unsuspected.

Another striking result was the marked effect on grain yields of comparatively short periods of discharge. Electrification for the first, second and third month, respectively, of the growing season gave in all cases large increases of grain, the second monthly period being the highest of the series with a yield more than double that of plants not subjected to the discharge. How far such a large increase may be expected in other seasons remains to be determined.

In one experiment plants were subjected to a discharge of a lower intensity than any hitherto employed, the current being only about 100 times the value of the normal atmospheric current. This current, which was continued for the full period, was apparently as effective as the stronger current, except in the case of plants electrified for the second month.

The removal of plants from the influence of the normal atmospheric current was accompanied by a slight reduction in yield.

The pot experiments are referred to in detail in the Committee's Report.

**Economic Installation at Rothamsted.**—A field installation was erected on Fosters Field at Rothamsted in 1922 on an economic scale (*i.e.*, with poles spaced widely, and with high wires, so that no undue interference was caused to farming operations), the object being to determine the kind of installation suitable for the purpose, the current required, and the cost.

The area under the influence of this installation (assuming the discharge to be effective for 15 ft. beyond the wires on all four sides) is about 5 acres. The installation consists of 9 creosoted poles each 24 ft. in length, of which 6 ft. is sunk in the ground; 4 of the poles are in the field and 5 in the hedges. The supporting wires at the ends of the area and in the middle of the area are of rustless mild steel (No. 12) each 125-150 yards long. There are 12 thinner wires (No. 26) of silicium bronze, each 200 yards long. The porcelain rod insulators are 18 in. long. The cost of the installation and its erection (materials, carriage, labour, travelling expenses and supervision) was £52. or about £10 per acre.

The Agricultural Electric Discharge Company have supplied the Committee with estimates of the cost of erection of an economic installation in areas of various sizes. The cost of the poles, insulators, and wires for 100 acres is £215, *i.e.*, slightly over £2 per acre, so that it is obvious that the price for small installations is no criterion of the cost in actual practice. The fact that fields are not of the size of 100 acres hardly affects the question since several fields can be included in one installation.

**Electrical Measurements, 1922.**—The measurements were taken at Rothamsted (1) on the wheat plot, (2) on the stubble after the wheat crop was removed, and (3) on the field under the economic installation.

Before these experiments doubt might well be entertained whether even a rough estimate of the current passing to the crop could be derived from the measurements of the current passed into the overhead wires. It now seems fairly certain, however, that with overhead wires whose distance apart is not much in excess of their height, fully half the current supplied to the wires may be expected to reach the crop. It is also clear that a very considerable area surrounding the electro-culture area, especially on its leeward side, receives a discharge much in excess of that which passes normally between air and earth.

**The Committee's Work in 1923.**—The results obtained in 1922 indicated the importance of concentrating attention on pot-culture experiments, small plot experiments and laboratory work. The experiments of 1922 on the effect of the discharge during different growing periods and different daily periods are being repeated in 1923; the effect of very weak currents and the effect of screening the plants from the normal atmospheric current are again being studied.

The results obtained from pot experiments are not always reproduced in the field owing to the effect of subsoil and other factors. Small plot experiments are, therefore, being carried out at Rothamsted and Lincluden for comparison with the results of the pot-culture experiments; the discharge is being applied for three different periods:—one, two, and three months respectively.

The economic installation at Rothamsted is being used for crop electrification, and measurements will also be made of the electrical conditions in and under that installation.

It has been found that the effect of the current is greater a short time after the application of the discharge has ceased than during the period of the discharge. Laboratory experiments are therefore being carried out to ascertain the minimum period of



electrical stimulation giving the greatest after effect as exhibited by an increase in the rate of growth.

Work on a field scale is being suspended during 1923, except for small plot work and the collection of data from the economic installation.

The results obtained from pot-culture work in 1922 are important, *inter alia*, from the point of view of the installation required on an economic scale. If it were necessary to apply the discharge for one month only, a very temporary installation could possibly be used, with consequent reduction in cost. Different fields could possibly be treated with the same installation. With lower heights of wires a lower voltage would suffice, and it might even be possible to apply the discharge by means of apparatus comparable to a "Knapsack Sprayer" or some ordinary agricultural implement. The Committee are keeping this aspect of the question in view.

**Future Work of the Committee.**—It is clear that the electro-culture problem is an intricate one with both physiological and agricultural aspects, and one which is far from being fully elucidated. The Committee's investigations, however, may be fraught with the most important consequences to agriculture as the results hitherto attained clearly indicate.

By a series of field experiments spread over a number of years the Committee have shown the type of electrical apparatus most suitable for the production of the high-tension discharge and have also shown that an increase of 20 per cent. can be obtained with certain cereal crops. That such results should have been obtained is very striking when the poverty of our knowledge of the conditions under which the electric discharge should be applied is taken into consideration. The Committee hold that a study, by laboratory and pot-culture methods, of the effect of the discharge at different stages of the plant's growth, of the effect of different daily periods of discharge, and of different strengths of current, will throw much light on the proper conditions under which the discharge should be given in the field. The Committee are confirmed in the view by the remarkable results obtained in 1922 when in pot-culture experiments an increase of 118 per cent. was obtained with only a single month's electrification.

Such results as these are of very great promise, for if lesser increases of 40 or 50 per cent. can be obtained in the field there can be no question of the economic application of electro-culture. The Committee therefore propose in the year 1924 as in 1923 to

confine the work to pot-culture and small plot experiments, and to laboratory investigations. It is proposed, however, that in 1925 field experiments shall again be undertaken on the basis of the scientific knowledge acquired in the previous years. The Committee expect by the end of 1925 to have made very definite progress in knowledge of electro-culture, and a definite advance towards its practical application.

The Committee understand that a period of 20 years was required to complete the investigation into a systematic application of fertilisers. The electrical problem appears to be even more complex, but from the results already obtained the Committee believe that positive and economic conclusions will be reached within a much shorter period than the problem of fertilisers required if investigations are carried on continuously.

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## GRADE "A" MILK—IS IT WORTH WHILE?

F. A. Cox.

IN the hope that the matter may be of interest to others who feel inclined to embark on the same procedure, an attempt has been made to give here a description of the alterations in equipment and methods on my farm near Oxford, which has recently diverted its energies from the production of ordinary to Grade A (tuberculin-tested) milk.

To begin with, our experience of the tuberculin tests may be interesting, perhaps encouraging, to others. Two reactors only, in a test of twenty-five, were found on the first occasion, and six months later a purchased heifer reacted to the eye test. These animals have been removed. This result, it will be agreed, was highly satisfactory, and we were then well prepared to proceed with the necessary modification of the buildings, a description of which follows.

**Milk Room.**—Methods under the old system were probably similar to those obtaining on a good many farms. Cooling was done in the scullery attached to the farm house. This state of affairs obviously could not continue. Cooling and washing up needed to be done in a separate building, and accommodation found for a steam boiler for sterilising purposes. Before anything was decided on, it was considered advisable to see the arrangements existing on other farms, and a visit was paid, under the auspices of the National Institute for Research in





FIG. 5.—Interior View of Dairy showing Washing and Sterilising Arrangements.



FIG. 6.—Showing the Interior of Shed before Re-construction.



FIG. 7.—Interior of Shed after Re-construction.



Dairying, to those near Reading described by Major H. P. Maule last year.\*

After looking round for a suitable building for conversion into a milk room, it was decided to commandeer the domestic coalhouse—at first sight a most uninviting place. Imagine a substantial stone building practically devoid of light and measuring inside 15 ft. by 8 ft. 6 in. Fig. 1 is a plan showing details of the alteration made here. Glass slates in the north side of the roof were the easiest solution of the lighting difficulty. A concrete floor was laid, and a slab partition put up dividing the building into two rooms approximately 7 ft. 6 in. by 8 ft. 6 in. That with direct external access was fitted up as a washing and sterilising room. Fig. 5 shows the equipment of this room, with washing up trough and steriliser, with the necessary steam and water fittings. The steriliser is of a new type, built of brick cement plastered, and fitted with a wooden lid. A drainage hole is situated at the bottom, and no attempt has been made to make the steriliser steam-tight. Dimensions are 7 ft. 6 in. long by 2 ft. wide by 3 ft. high, giving ample room for about five twelve-gallon churns and cooler, buckets, filter, etc., at once. This steriliser, besides being inexpensive, has proved very efficient, no difficulty having been experienced in getting the necessary temperature of 210° F.

The other room was fitted up for cooling purposes, the cooler being supported on irons let into the wall. A bucket rack of galvanised pipe was fitted, but is little used, as it is found more convenient and satisfactory to leave the utensils in the steriliser till required.

All walls were cement plastered to a height of 5 ft., the roof covered with match-boarding, and angles between wall and floor rounded out. Whitewashed walls and the provision of a drain completed the necessary work here.

The boiler (Fig. 1) is housed some distance from the milk room, being connected thereto by some 40 ft. of pipe, lagged to prevent loss of heat. The building housing the boiler is a hog-tub house, an old copper being removed to make room, and the boiler is available for steaming pigs' food as well as sterilising, if necessary. The boiler was obtained cheap locally, this fact enabling us to keep the cost of the milk room and sterilising equipment down to the reasonable figure of about £60.

**Cowshed.**—This is situated some twenty yards from the milk room. Fig. 6 shows the appearance of the old shed, Fig. 3

\* This *Journal*, Sept., 1922.

being a section of the same place. It had few redeeming features, with the exception of the fact that the building itself was substantial and sound. Cobble floor, high mangers, standing too long, insufficient lighting, bad drainage, are all objectionable. Fig. 7 shows the shed after alteration, the dimensions being given in Figs. 2 and 4. The roof is of double Roman tiles, and glass tiles of the same section were readily obtained and formed an easy means of improving the lighting. Some thought had to be expended on Fig. 4 before satisfactory dimensions were arrived at, the shed being a rather narrow one

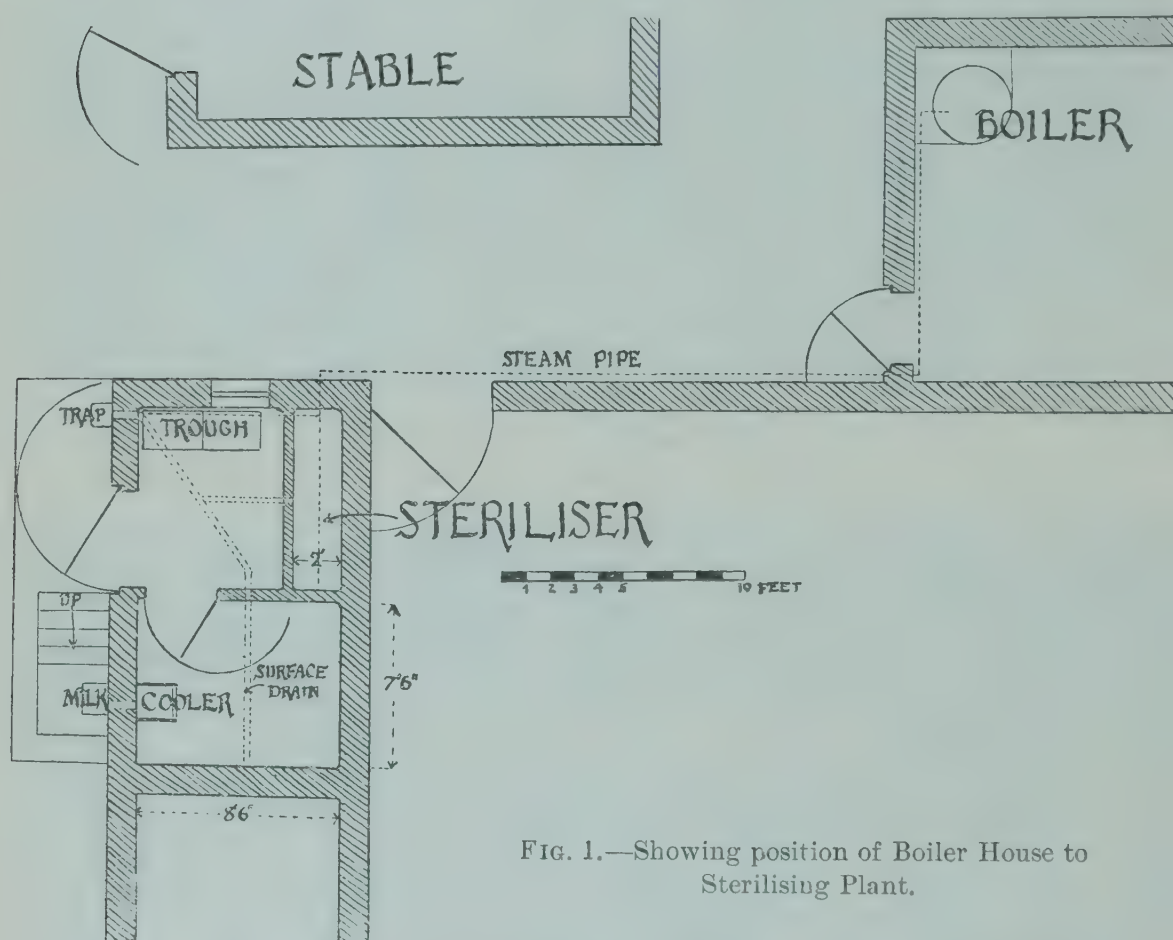


FIG. 1.—Showing position of Boiler House to Sterilising Plant.

(15 ft. only), for the inclusion of a feeding passage. Had more room been available the gutter would have been 2 ft. instead of 14 in., and the manger 3 ft., as we find the cows are inclined to drop some food over the manger back into the passage. The fittings used are British and cost £2 10s. per cow. The mangers are built up of slabs, cement plastered, and the divisions have an opening at bottom to permit of flushing the whole range from end to end. All angles in floor and manger are rounded out to provide no lodgment for dirt, and the back wall is cement plastered to a height of about 3 ft. to facilitate cleaning.



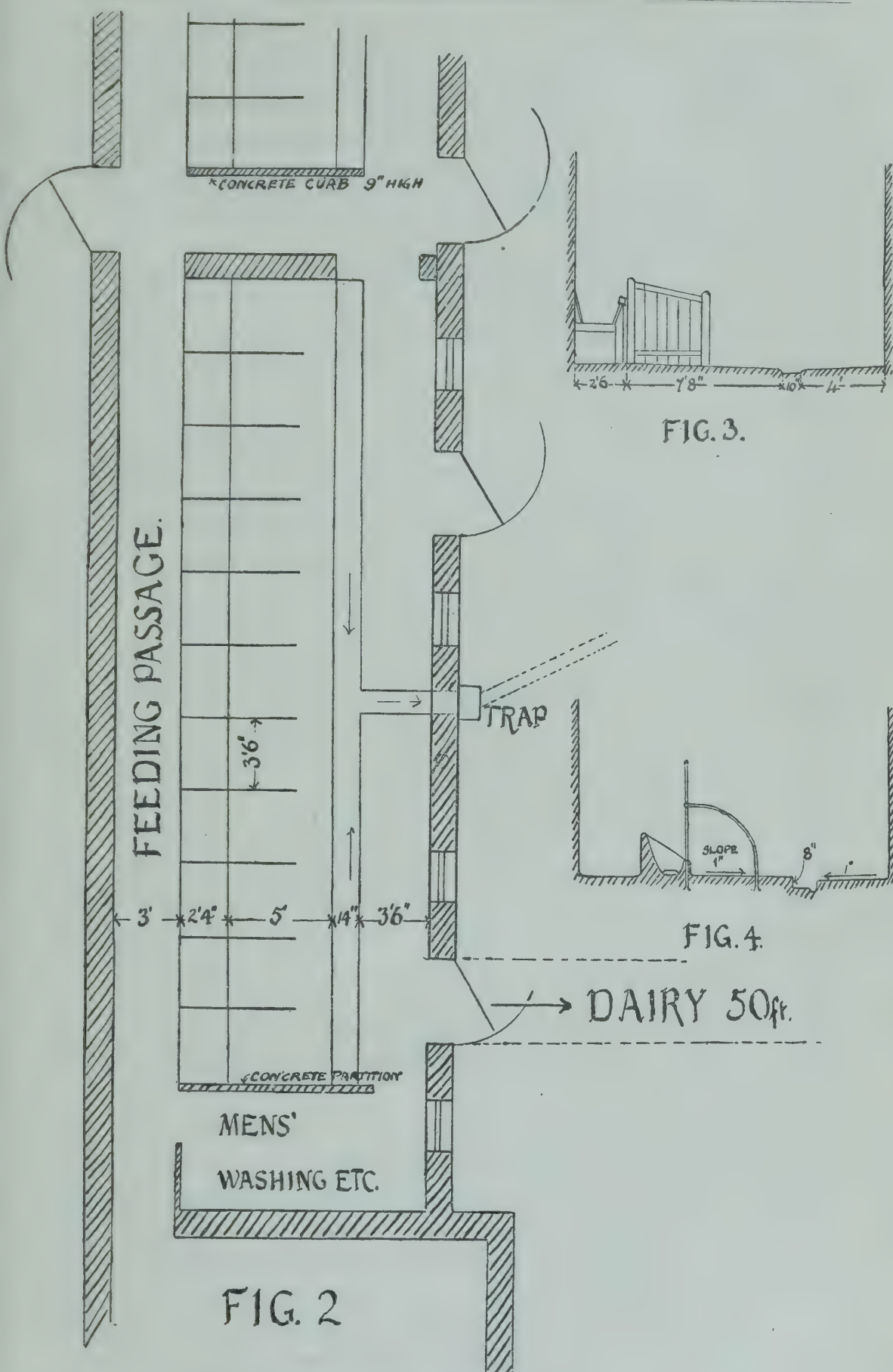


FIG. 2.—Plan of re-constructed Shed.

,, 3.—Section of Cowshed before re-construction.

,, 4.— ,, ,, after ,,

Ordinary farm labour only was used throughout this work, and while the appearance may not be equal to that of the best professional work, the result is quite satisfactory. Unfortunately no account was kept of time put in on the work, but as near as can be estimated the total cost, including fittings, of conversion of this shed was approximately £5 10s. per cow, a very reasonable figure.

Fig. 2 also shows the arrangement that is being adopted to provide accommodation for milking suits and for washing men's hands: two stalls at the top end of the shed are dispensed with, a partition dividing this portion from the remainder of the shed.

Drainage of these buildings was a comparatively simple matter, as a system of sorts was already in existence, and also a liquid manure tank. This system was overhauled and new drains from the cowshed and milk room were connected to it. All drains passed through the wall into a suitable trap outside.

In conclusion, a few remarks on the practical aspect of the production of Grade A milk will not be out of place. It is recognised that the cost of production is greater than that of ordinary milk. Certain charges cannot be avoided, such as interest on capital outlay in conversion, veterinary surgeon's account, etc., but actual running expenses can be kept down by careful management. For example, with a slight readjustment of labour it has been found possible to produce Grade A milk from this herd of some 20 cows without any increase of staff. A small amount of extra time is involved, which would mean, roughly, 5 men, or 4 men and a boy, where 4 men sufficed under the old conditions. It has always been the practice on this farm to wash the cows' udders, and we find in the new shed that the cows, when lying in, keep themselves much cleaner than previously, and little labour is required in cleaning them.

Economy in boiler fuel is possible by the method adopted here. Utensils are washed in cold water after the morning milking. The boiler fire is lit about 11.30, and steam is usually available after the dinner hour, when the utensils are thoroughly scoured, rinsed and steamed. The fire is then damped down to keep the boiler in readiness for the afternoon steaming. By this means the boiler is only hot for 6 hours a day and fuel consumption is kept at a minimum.



## STRAW ROPES AND STRAW ENVELOPES—THEIR MANUFACTURE AND USES.

*Communicated by the Rural Industries Intelligence Bureau, 258, Westminster Bridge Road, London, S.E.1, where reprints can be obtained.*

A DESCRIPTION of some of the industrial uses to which straw is put and the methods adopted in preparing it, may be of interest to many, who perhaps have not realised the importance of straw to a number of different trades. The practical economy of any process which will increase the value of the raw article and which at the same time should make it both easily marketable and provide useful employment in the country will be quite apparent.

**I. STRAW ROPE.**—Of the two processes to be dealt with in these notes, the production of straw rope is simpler, perhaps more remunerative and better suited for unskilled labour than the manufacture of straw envelopes.

**A. Its Uses.**—1. *As a Packing Material.*—Furniture and bedstead makers, electric conduit tube makers and brass and copper tube manufacturers all use straw rope as a packing material to protect the enamelled, polished or lacquered surfaces. Straw rope is also used in the packing of fragile goods, pottery, glass ware, enamelled hollow ware and stone ware. Again, coils of barbed wire for export are frequently covered with it—not as protection to the wire, but to enable it to be handled easily and to prevent damage to other goods in contact—and chemical manufacturers use it for surrounding carboys, etc.

Straw rope is also sometimes employed in chemical and other factories as a cheap form of lagging for boilers, steam pipes, hydrants and exposed piping, when they are not exposed to undue risk of fire. This use is, however, much more common on the Continent than in England. When required for boiler lagging, the rope is made as large in diameter as possible; it is then coiled tightly round, driven close and afterwards covered with about 2 inches of clay or marl, mixed with chopped straw, grass or other dried fibre in order to prevent the caked clay when dry becoming detached in a mass. A little teased-out hemp is also a very good thing to mix in with the clay.

2. *In the Foundry Trade.*—Straw rope is also a great deal used in the foundry trade chiefly for large and heavy work, as a

corebinder and occasionally as a mould stiffener. At one time it was part of the regular work of the coremaker to twist up the straw by hand into rough ropes as required. Nowadays, it is cheaper and more satisfactory to buy it ready spun, and a good deal is imported for this purpose, which could be made quite as well and as cheaply in this country. Some large iron foundries, however, possess their own rope-making plant.

For large work, rope about  $1\frac{1}{4}$ - $1\frac{1}{2}$  in. in diameter is chiefly used. For smaller or more complicated cores, straw is not so suitable as wood wool rope which is often employed in spite of the fact that it is more expensive. Indeed, for many or all of the industrial uses outlined above, wood wool is probably a better article to use than straw, but as the rope can seldom or never be retained for use over again, the cost of the latter is frequently prohibitive.

3. *For Straw Mats.*—The machines used for spinning straw ropes can also be used for rush and reed ropes used in the making of coiled rush mats; and the installation of one or two machines might be of great advantage to an existing industry of this sort. There is no particular reason why straw should not be used in making mats of this kind to a greater extent than is done at present, and there might well be an opportunity here for the establishment of a promising village industry. Such mats should command a ready sale, as the cost ought not to be more than one-third to one-fourth of the cost of coir mats.

For mats, *rye straw* spun into ropes from  $\frac{1}{2}$ - $\frac{3}{4}$  in. in diameter is the best. Sewn together with fine twine and backed with Hessian, the mats could be made up in a flat coil either round, square or oblong in shape. In order to introduce variety and to improve their market value, the straw could be dyed before being made into rope.

4. *On the Farm.*—On the Continent, the farm uses of straw rope are generally recognised and a special type of spinning machine for agricultural uses is on the market; the machine is usually hand operated, but can be had adapted for power drive. This machine makes straw ropes in short lengths up to 7 feet in small diameters of say  $\frac{1}{2}$ - $\frac{3}{4}$  in.; and by using this, the farmer can for many or most purposes save the expense of binding twine. For thatching and ricking, the use of straw ropes often means a saving of time and labour as well as an improvement in appearance.

*The sizes and quality of straw rope* required in industry vary greatly according to the purpose for which they are needed;  $\frac{3}{8}$  in.



diameter is about the smallest that can be satisfactorily produced, and  $1\frac{1}{2}$ - $1\frac{3}{4}$  in. diameter are about the largest that are normally required, although larger ropes than these are occasionally made. The larger sizes are chiefly used in the heavy iron foundry trade, which often requires a hard rope—from  $1$ - $1\frac{1}{2}$  in. in diameter. Wheat straw is useful for this purpose, or barley straw when a softer rope is demanded. Makers and exporters of lead ware, such as pipes, guttering, etc., prefer a very soft rope of about the same size, and for this, barley straw only would generally be used. The sizes most generally in demand are  $\frac{1}{2}$  in.,  $\frac{3}{4}$  in., 1 in.,  $1\frac{1}{8}$  in. and  $1\frac{1}{2}$  in.

**B. Varieties of Straw.**—1. *Oat Straw*, owing to its value as a food, would not perhaps be used to any great extent, but, when available, it is suitable for making very good quality medium hard rope. It is best suited for sizes say  $\frac{3}{4}$ -1 in. in diameter.

2. *Barley Straw* is about the best of all for making rope for packing purposes. In diameters of  $\frac{3}{4}$  in. to  $1\frac{1}{2}$  in. it makes a very soft rope; it is not very satisfactory for making the smallest sizes of  $\frac{3}{8}$ - $\frac{1}{2}$  in., but  $\frac{1}{2}$ -in. ropes can be made quite well if the straw is of good quality. As barley straw is cheap, and has not so great a value for farm purposes as other kinds, it can probably be generally employed with advantage in rope manufacture. The difficulty with this straw is that it is often too short to make a strong rope.

3. *Wheat Straw* being rather brittle, is not satisfactory except in ropes of fairly large size, i.e., 1 in. to  $1\frac{1}{2}$  in. or over. It is best made into hard ropes such as are frequently required for foundry work, and it can also be used for lagging purposes.

4. *Rye Straw* is probably about the best straw of all to use. Most of the Continental imports are made of this, and being long and tough, it is particularly suitable for making ropes in the smaller sizes such as  $\frac{3}{8}$  in. to  $\frac{5}{8}$  in. diameter, but the larger diameters can be made from it equally well.

Little, if any, difference in price for the rope can be expected from using various kinds of straw except that a loose and comparatively weak rope from short barley straw would have a lower value.

**C. Weights and Prices.**—Considerable variations seem to obtain in the weights of manufactured straw ropes, as given by different authorities. These differences, however, chiefly occur in the larger sizes and are to be explained by variation in the closeness of the twist, i.e., a soft loose rope is decidedly lighter than a hard closely twisted one.

The prices of imported ropes have fluctuated greatly during recent months and are at present high owing mainly to a severe Continental straw shortage. The prices given in the following tables are rates quoted for Dutch ropes in April, 1923—c.i.f. Hull, Grimsby, Goole, Leith, etc., and are for rye straw per 1,000 yards.

These ropes are consigned in 500-yard bales in the  $\frac{3}{8}$  in.,  $\frac{1}{2}$  in.,  $\frac{5}{8}$  in. and  $\frac{3}{4}$  in. sizes and in 250-yard bales in the larger diameters.

The two tables are calculated on the highest and lowest range of weights which have been communicated to us.

Table I.

<i>Diameter of Rope—in.</i>	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.
Weight per 1,000 yards, approx., lb.	30-32	45-50	65-70	90-100	180	250	358
Price per 1,000 yards ...	8/1	8/8	9/8	11/-	16/2	20/5	22/6
Yards per ton, approx....	72,000	48,000	33,000	23,600	12,500	9,000	6,200
Value per ton, approx....	£29 2	20 16	16	12 13 4	10 2	9 3 9	6 19 6

Table II.

<i>Diameter—in.</i>	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.
Weight per 1,000 yards, approx., lb. ...	46	62	99	154	200	242
Price per 1,000 yards ...	8/8	9/8	11/-	16/2	20/5	22/6
Yards per ton, approx. ...	49,000	36,000	23,000	14,500	11,200	9,250
Value per ton ...	£21 4	17 8	12 13	11 14	11 9	10 8

**D. The Rope Spinning Machines.**—To produce straw rope economically and with any hope of competing with the imported article in supplying the needs of industry, special machinery is essential. A hand-operated spinner would probably suffice for making the short lengths and comparatively small quantities required by the farmer for his own use, but power driven plant would be required for anything beyond this.

It has not been possible up to the present to obtain particulars or prices of any machines suitable for the purpose, made by English manufacturers, or even to ascertain that anything of the sort is at present on the market, but no doubt once the demand for such apparatus arose, reliable home-produced equipment would soon be forthcoming.



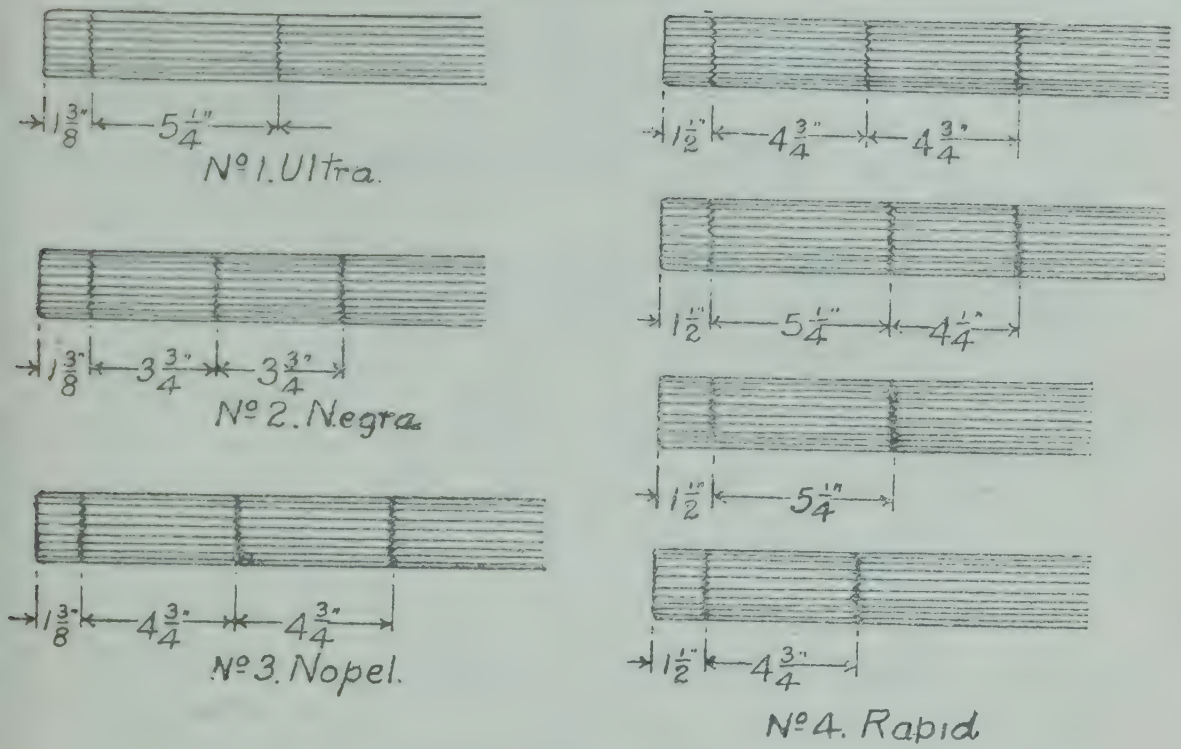


FIG. 1.—Methods of Sewing Straw Envelopes.

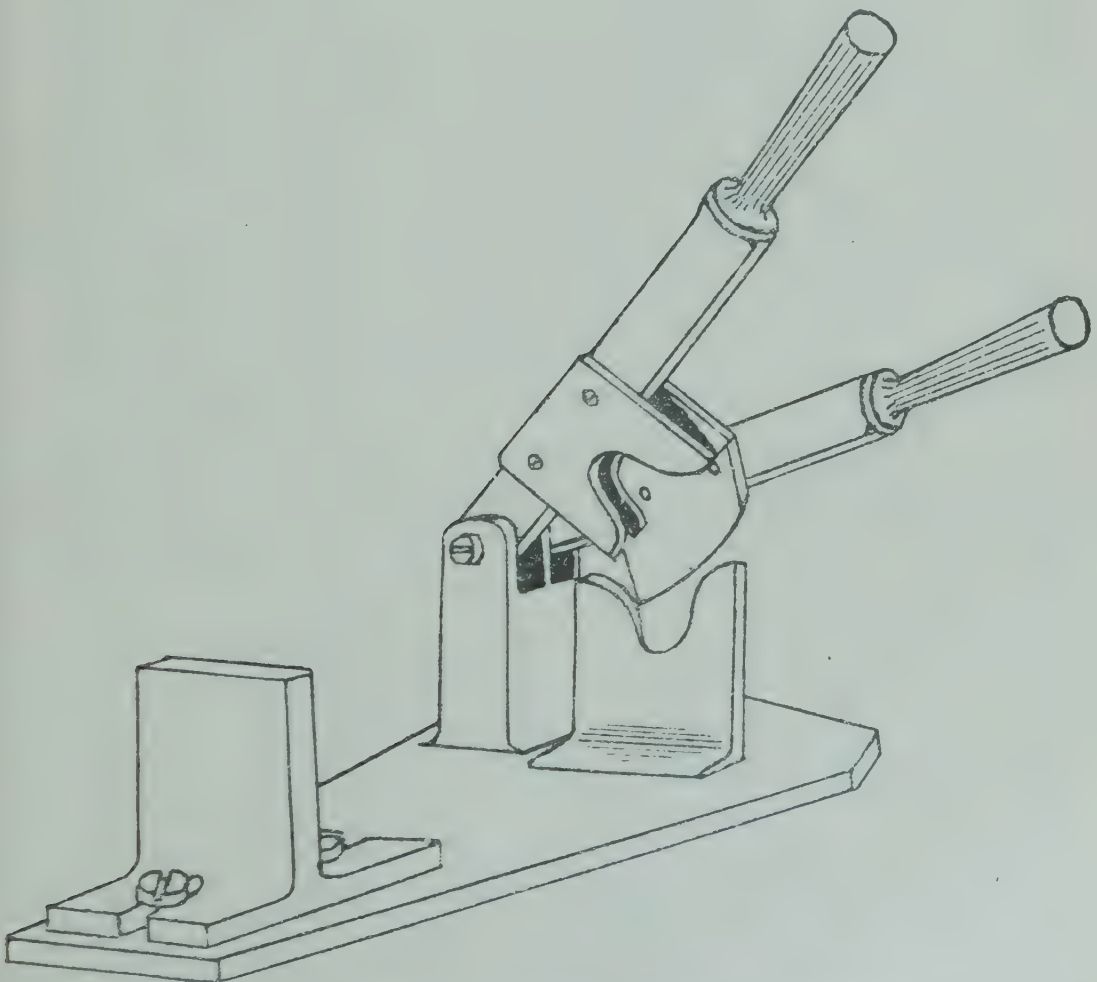


FIG. 2.—Straw Envelope Header and Trimmer—Hand-operated.

There are several patterns of Continental manufacture available. They differ little from one another except in minor details. Perhaps the simplest and most reliable of these is the "Concordia" machine, of which a general description is given below.

This type is made in 6 patterns for varying sizes of ropes:—

No.	Capacity.		Remarks.	Approx. H.P. reqrd.	Revs. per min.
	Length of Rope.	Diameter.			
		in.			
1.	7-8 feet ...	$\frac{1}{2}$ - $\frac{3}{4}$	Hand operated	—	—
2.	7-8 feet ...	$\frac{1}{2}$ - $\frac{3}{4}$	Power ...	0.5	50-60
3.	Up to 250 yd. ...	$\frac{3}{8}$ - $\frac{5}{8}$	" ...	0.5	40-60
4.	do. ...	$\frac{5}{8}$ -1	" ...	1.0	50-100
5.	do. ...	1-1 $\frac{3}{4}$	" ...	1.5	80-100
6.	do. ...	1 $\frac{1}{2}$ -2 $\frac{3}{4}$	" to special order only.	2.0	80-100

These machines produce ropes of two strands. The straw, which for good rope should be no shorter than 30 in. and preferably 3 ft. in length or over, is placed into two long narrow troughs, from which it is fed by hand as required. The ends of the straw are gripped by scored rollers, which carry it forward to the spinning boxes, where it receives a half twist—one layer over another. From here the rope passes across a pulley or through a guide to the forming box, which gives the rope its final twist and, if it is required, a sewing attachment fitted to the machine will automatically sew up the rope as it passes through this box to prevent it unravelling. A flattening device can also be put into action if necessary. This forms the rope, as it passes, into a more solid and compact state; but this is not needed in all cases. Immediately after this point, the rope is caught between the two ejecting rollers, which grip it and force it through a guide, whence it passes out to the winding drums upon which it is coiled. The drum or reel can be fitted with an adjustable brake, and also with an arrangement by which the rope is wound evenly backwards and forwards upon it. A device may also be attached by which a bell is rung when the reel is getting full, in order to warn the attendant to stop and change or empty the drum.

As soon as a coil is removed from the machine, the severed end should be tied to prevent unravelling. Clipping gear, for shearing off the projecting ends of the stubble which stick out as a result of the first folding over operation, is usually fitted



to work between the first and second operations. It may be either in the form of a revolving knife or pairs of automatically operated shears.

A measuring apparatus, which will automatically stop the machine when a predetermined length of rope has been made, can also be fitted.

The size of the rope spun depends upon the amount of straw fed in by the operator from the troughs; and here skill and experience count in producing good firm and uniform ropes.

The output of the machines is stated to be approximately as follows, but it is doubtful whether the higher of the rates could be continuously maintained for any length of time:—

Small diameter	...	$\frac{3}{8}$ – $\frac{5}{8}$ in.	about 5– 8 yd. per minute.
Medium „	...	$\frac{3}{4}$ –1 „	„ „ 7–10 „ „ „
Large „	...	1 –1 $\frac{3}{4}$ „	„ „ 6– 7 „ „ „

The larger sizes will require two operators feeding in straw to give this output.

The use of the various sewing, flattening and clipping attachments does not interfere with the rate of production.

The hand-worked machine is generally similar to the power-driven one except that it has no winding-off reel. The rope is delivered on to a kind of projecting shelf and cut off when the length is reached for which the knives are set.

Present prices of machines are as follows. These are liable to fluctuation with the Continental rates of exchange.

Size	Nos. I & II	...	£43 approximately.
„	No. III	...	£46 „
„	No. IV	...	£48 „
„	No. V	...	£57 „
„	No. VI	...	On special application only.

*Extras.*

Stubble Clipper	...	£1
Warning Bell	...	£2
Extra Reels	...	£1 each
Straw Cradles	...	£1 10s. per pair
Automatic Measuring Gear	...	£4

A few remarks upon points to be considered by any one proposing to instal machinery of this kind will not be out of place.

Though they may seem rather complicated pieces of apparatus, they are in reality no more so than many other machines now used on the farm, and should not require a great deal of expert attention. Unless power is already installed and

used for other purposes as well it would probably not be so economic to put in one straw rope machine alone, as the overhead charges would tend to be rather high.

The amount of straw provided by, say, 300 to 350 acres of arable land should be sufficient to keep two or even three machines going and still leave enough to be reserved for ordinary farm uses. An oil engine of 3-4 H.P. would supply sufficient power. It would, however, not be advisable to put in anything much smaller for only one machine, and intermediate shafting will probably be necessary, even in this latter case, to step down the speed of the engine to that required by the rope-making machine.

The labour involved in tending the machines is not heavy, and it is quite possible to employ boys or girls. Two girls should be able to make from 2,000-2,500 yd. of  $\frac{3}{4}$ -in. rope in an 8-hour working day. It will be noticed that this figure is decidedly below the capacity of the machines mentioned above. Those figures given by the machine-makers, probably relate to conditions which would not obtain with the small user, who would not, as a rule, employ additional labour to remove and empty the drums and get them ready to put up again on the machine. Unless, therefore, a very large number of spare drums was available, as well as extra hands, the plant would not be running continuously, and in practice 2,300 yd. per day per machine must be considered a fair average working output.

Anyone situated near a large town may find another subsidiary use for a straw rope spinning machine. A lot of upholstery is done with Algerian and Coco fibre. When this fibre is wanted to be used over again, it has to be treated in order to restore its springiness or "curl," and it is therefore roped or twisted by the upholsterer before being carded. This roping is usually performed slowly and uneconomically by hand, but could be cheaply and quickly done by the straw rope spinner.

In conclusion, it may be said that straw rope is an article of extensive and extending use in many different forms of industry. At present the demand is met very largely by imports, but as conditions of trade improve, it should be possible to establish its manufacture in this country on a sound remunerative basis. The demand is a large and steady one, and a great advantage from the point of view of both maker and dealer lies in the fact that straw rope can seldom be used twice.



**II. STRAW ENVELOPES FOR BOTTLES.**—The trade in these articles has fallen off somewhat in late years, but is still considerable. The following figures for quantity and value of imports are given by the Board of Trade:—

<i>Imports</i>			<i>Value</i>		
1913	1920	1921	1913	1920	1921
Gross	Gross	Gross	£	£	£
1,047,302 ...	667,085 ...	471,635 ...	96,888 ...	159,630 ...	103,593

The majority of straw envelopes now come from Holland and France and are very largely used in the export trade. For internal transport they have been for some years rather superseded by sectional returnable packing cases, with corrugated straw board as an extra protection to bottles with specially valuable contents. The main advantage of these cases is that less space is occupied, but they are rather more expensive and less efficient in preventing breakage than straw envelopes, hence the use of the latter in the export trade as a rule. The straw envelope has lately been regaining its old position in home transport as well.

The principal users in this country are the cider makers in Somerset, Devon and Wilts, the whisky trade, bottling firms and exporters at various seaports, and the chemical and confectionery trades.

The machinery used for producing envelopes is easy to work and makes them very rapidly. The output of the different sizes varies from 200 up to about 500 envelopes per hour with power drive. The smaller sizes can also be worked by treadle if desired, but the output is of course less. There is no doubt, however, that these sewing machines are rather more complex and delicate pieces of mechanism than the general run of agricultural machinery and while they are in fact very easy to work and intended to be operated by unskilled labour or by girls, a skilled mechanic would be required to look after them at intervals. For this reason they are probably more suited for a factory than a farm.

**Process.**—The following is a general description of the method of making straw envelopes; details and the sequence of operations may vary somewhat with different types of machinery. The straw, when it has been “hackled” or combed out to lie evenly, is placed in a trough alongside the sewing machine. At this stage, if it is much longer than is required, it is cut to a length about 1 or 2 inches more than twice the length the finished envelope will be, by means of a

guillotine knife at one end of the trough, the proper length being obtained by a wooden stop plate which can be fixed at any required distance from the knife. Under factory conditions or for large output, the "hackling" and cutting to length would be distinct operations; the material would then be brought to the seaming machine operation ready for use. The straws composing the envelopes are doubled over upon themselves before being sewn together (*i.e.*, for a quart bottle envelope which is about 15 in. long when finished, the straw would have to be 30 in. long plus an allowance of  $\frac{1}{2}$  in. to 1 in. for trimming after "heading" and "tying").

There is no particular objection to the ears being left on, provided that the tied end of the envelope is long enough for them to be clear of any row of stitching. In practice the ears are often found left in, but in the best quality envelopes made of rye straw which grows long, they are generally absent. Great accuracy in length in this first stage is not necessary, provided always that the straw is more than double the length of the finished article. All the sewing takes place at a fixed distance from the fold of the straw, which forms the open bottom end of the envelope.

It is essential that the straw should be thoroughly dry; damp straw will rot the thread, and is liable to split, and will produce damaged envelopes, when they are pressed into bales for transport.

The operator now takes a handful of straw and lays it in position on the operating table of the sewing machine; it is here that skill and experience are chiefly required to put on just the right amount required to make a good envelope, which should be firm, of the proper weight, and even in texture all round with no open or thin and loose patches. The necessary skill is soon acquired by practice, and the speed at which a good worker can feed the machine is very high. The working table of the machines is known as "the book"; it is hinged at the centre and the straw is placed upon it when lying open, and spread evenly out; the "book" is then shut with a metal finger piece, something like a book marker slipped in at the centre. The straw is thus doubled over evenly on itself. The thin finger piece can then be pulled out, and the folded straws are sewn together.

At one time the envelopes were sewn merely as a flat straw sheet which was then bent round to a circular shape and tied by hand, but practically all modern machines, such as those



referred to in this article, produce the envelopes in the finished circular form required. The envelopes are given 2 or 3 rows of stitching according to the size or the machine used; it is usually the ordinary chain stitch which can be easily cut without unravelling. It is only a very large envelope that requires 3 rows.

**Straw Envelope Sewing Machines.**—The machines, of which particulars and prices are given below, are of German or Dutch manufacture, and so far as it has been possible to ascertain there is no English make obtainable.

<i>Trade Mark.</i>	<i>H. P.</i>	<i>Type.</i>	<i>Capacity.</i>	<i>Approx. Price.</i>	<i>Power.</i>
1. "Ne Plus Ultra"	$\frac{1}{2}$	2 stitch ..	per hr. 200-250	£50 £55	Power Foot treadle
2. "Negra" ...	$\frac{3}{4}$	3 stitch...	200-280	£53 £59	Power Treadle
3. "Nopel" ...	$\frac{3}{4}$	3 stitch...	250-300	£58 £64	Power- Treadle
4. "Rapid" ...	1.0	2 or 3 stitch.	400-500	—	Power only

No. 4 is a large machine and fully automatic. In this type, the position of the circumferential stitching is capable of adjustment or alteration to suit different bottle shapes. The envelopes produced range from 2 in. to about  $4\frac{3}{4}$  in. diameter (Fig. 1).

After seaming, the envelopes are "headed" by an appliance operated by hand or treadle. The operation consists of squeezing tight the loose (*i.e.*, unsewn) end of the envelope, binding it and clipping off any surplus straw. Squeezing and trimming and binding are performed in the one appliance. Fig. 2 shows a hand-operated "header"; the pallet is adjustable to accommodate different lengths of envelopes, which are held in the crutch of the machine, while being bound. The treadle-operated grip is, however, the more convenient as both hands are then left free for binding.

The hand-operated machine costs about £8 10s. 0d. and the treadle machine £11, but there is nothing very special about them and they could probably be made locally for less.

The finished envelopes are very light and bulky, and require baling for transport purposes, and a hand or power-press would be required for doing this—the hand-press costing from £25 to £40 according to capacity, the power-operated press rather more.

Envelopes are generally imported in bales of 2 gross. The size of a compressed bale of quart bottle envelopes is approximately 30 x 24 x 15 in. and the weight of such a bale should be 44 lb. The weights of envelopes vary of course very much according to size and are from about 8 lb. per gross in the very small special sizes to 35 lb. or more in the large envelopes required by the confectionery trade, say, for large sweet bottles.

The quart bottle size in most common demand runs about 22 lb. per gross.

**Prices of Imported Envelopes.**—Quart size is the standard article and special sizes either above or below this are generally rather higher in price; the very small sizes are considerably more expensive. Present prices (April, 1923) for quart size are as follows:—

			s.	d.	s.	d.	
Dutch manufacture	...	...	3	0	to	3	8 per gross.
- French	„	...	3	8	to	4	0 „ „

These prices are higher than they have been at any time previously, owing to the existing straw shortage in Holland, Belgium and France. But for this shortage, the price would be about 2s. 6d. to 3s. per gross only. Pre-war prices were from 1s. 10½d. to 2s. It is of interest to mention that the managing director of one of the largest London importing firms has recently stated that he would be very glad to deal with home-manufactured straw envelopes, if they could be obtained in good quality and quantity, and at a reasonable price.

The machines described in these notes may be obtained through Messrs. Country Industries, Ltd., to whom any inquiries as to prices and delivery should be addressed, while the Secretary of the Rural Industries Intelligence Bureau will be pleased to give any additional information which may be in his possession.

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## TRAINING IN COMMERCIAL POULTRY KEEPING.

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THERE are several reasons why it seems desirable to publish an account of the poultry department which is now very nearly completed at the Hertfordshire Institute of Agriculture, at Oaklands, near St. Albans. These may be summarised as follows :—

- (a) The whole department has been laid out on a definite plan with the result that both unity and completeness have been secured.

In considering the details a small committee of poultry experts, under the chairmanship of Mr. T. W. Toovey, has rigorously excluded any unnecessary elaboration, and adhered to the principles of economy and utility. The plant is, therefore, perhaps the simplest and most economical that is likely to be commercially successful.

Clearly the cheapest method of keeping poultry on farms would be the organized extension of the free run system, but the possibility of depredations by foxes should be borne in mind when choosing the site.

- (b) The houses which have been erected are of a type which has been proved to give good results, and the design is so simple that they are both cheap and easily constructed.
- (c) The main system of rearing is one that involves the fewest complications, while at the same time provision has been made for systematic natural hatching on a small scale.
- (d) The completed department consists of an 800-bird plant with all the necessary rearing facilities to maintain it, and at the same time to supply sittings of eggs, etc. This size has been determined upon as it provides a complete one-man commercial proposition.
- (e) The objects of providing this department are defined in the prospectus of the Institute as follows :—

(1) To demonstrate a system or systems of poultry keeping which actual accounts will show to be profitable, and which could be copied in the county with similar results.

(2) To provide the means of training young men and women in all details and processes in successful and profitable poultry keeping.

The information given should also appeal to the general farmer whether he thinks of keeping 100 or 1,000 birds. In these days farmers cannot afford to neglect any side line which might prove a source of profit. Poultry keeping on farms is too often neglected. This is most unfortunate as the farmer has often at hand the very conditions which would ensure a profit from well-managed poultry.

The Department was started in the spring of 1922. A month or two previously a score of pure-bred White Leghorn pullets and a "Daily Mail" laying house had been purchased at a sale, but apart from these two items the whole plant has been built up from nothing. Immediately after the poultryman had taken up his duties in March, 1922, steps were taken to commence hatching and to provide the necessary rearing houses. Eggs were purchased of reliable strains of Rhode Island Reds and White Wyandottes, and resulted in 300 pullets being reared. These came into profit from October onwards.

During the winter of 1922-3 further houses were completed in anticipation of hatching in the spring of 1923 enough birds to complete the stocking of the plant. To get the necessary eggs for hatching, a number of 2nd year breeding hens were purchased and mated with home-bred cockerels. These, along with the Leghorn pen and some cross-breeding pens, provided the required eggs for incubation or natural hatching. By the autumn of 1923 the plant will be complete.

**Incubation.**—An excellent incubator room was provided at very little expense in a disused stable, a portion of which was boarded off and the floor concreted. Electric light was introduced for convenience at night, and for testing eggs for fertility. On many farms there exist buildings which could be similarly cheaply converted. The rest of this building with part of the granary overhead is utilised as a food store.

Four incubators—two 100-size Hearsons, one 150-size Glevam, and one 150-size Gloucester were obtained.

**Natural Hatching.**—A natural hatching house has been provided to accommodate 16 sitting hens. The system is a copy of that so successfully practised by Mr. T. W. Toovey, of King's Langley. The total length of both the nest and the airing chamber is 3 ft. 3 in., 15 in. being taken by the nest



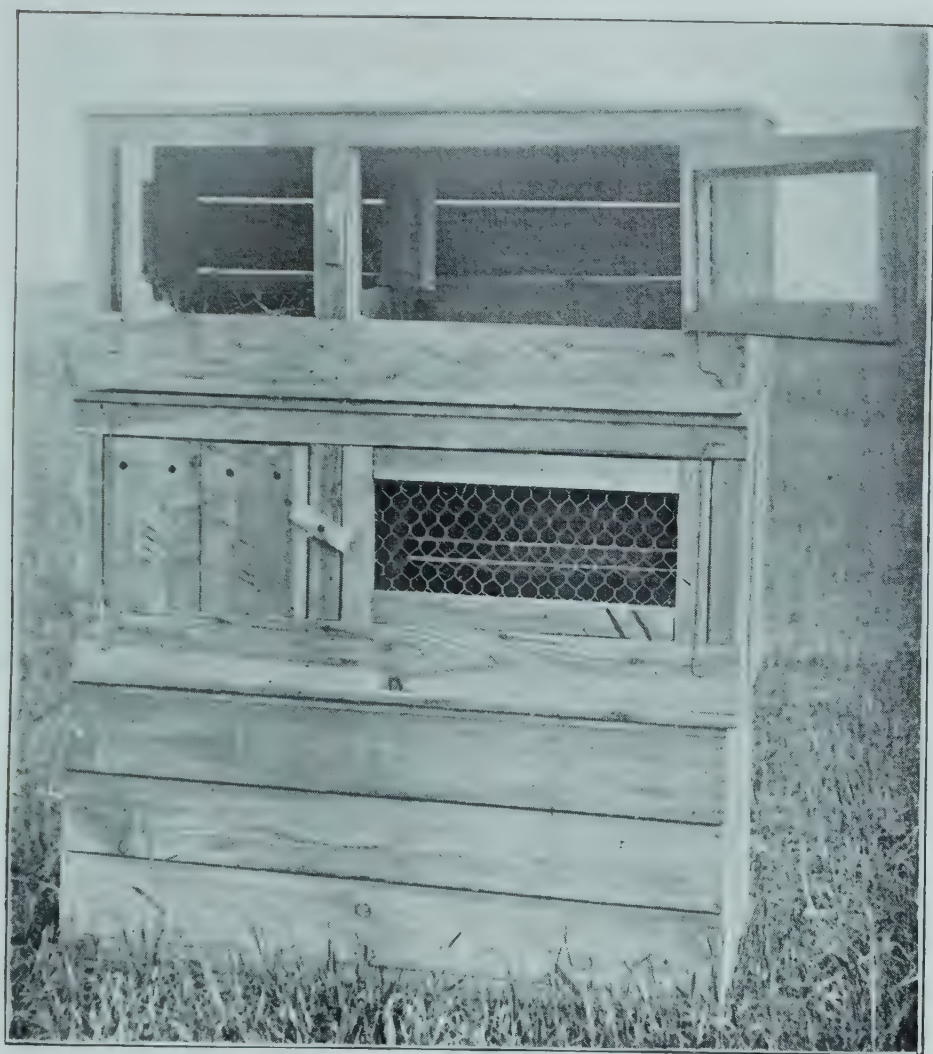


FIG. 1.—Nests for Natural Hatching.



FIG. 2.—Coops used in Natural Hatching.



FIG. 3.—Laying House.



and 2 ft. for the airing and feeding chamber. The depth is 17 in., and height 16 in. There are two doors in front and a small door between the nest and the airing chamber.

These nests can be arranged in any suitable building in tiers 3 or 4 deep. Quite a number of hens can, therefore, be set at one time, and require the minimum of supervision. On hatching, the hens with their broods are transferred to special coops which are set out in a series of small grass enclosures 10 ft. square. The use of these nests and coops (Figs. 1 and 2) enables natural hatching to be carried out on a small or a large scale, in a simple yet systematic manner.

**Rearing.**—Incubator chicks at 24 hours old are transferred to hovers which are placed in cabins 6 ft. square x 6 ft. high built for the purpose. There are now eight of these cabins, and these along with the "Daily Mail" house provide accommodation for 10 hovers. The hovers are designed for 100 chicks, but it is better not to exceed 70-80 in each. Each cabin is well ventilated and is situated on 500 square yards of grass run. The particular type of hover used is that made by Halsall. They are very simple in construction, and have given good results.

Chicks either from hens or from the hovers are transferred at 6 weeks old to the rearing houses, which are built to the same specification as the laying houses described below. Till the young birds learn to perch they are divided up into small units of about 30 by means of temporary and movable partitions of wire netting.

The following is a specification of one of the cabin houses:—

						£	s.	d.
240 ft.	...	6 in. F.E. boards at 14/-	per square	...	...	0	16	10
100 "	...	5 in. x $\frac{3}{4}$ in. match boarding at 23/6	per square	...	...	0	10	0
84 "	...	6 in. x $\frac{3}{4}$ in. rough boards	at 20/-	per square	...	0	8	5
182 "	...	2 in. x 2 in. " "	at $1\frac{1}{8}$ d.	per foot	...	0	17	0
60 "	...	2 in. x 1 in. " "	at $\frac{3}{4}$ d.	" "	...	0	3	9
72 "	...	6 in. x 1 in. " "	at $1\frac{1}{2}$ d.	" "	...	0	9	0
1 in. wire netting, 3 ft. x 3 ft.	...	...	...	...	...	}		
5 yd. felt...	...	...	...	...	...			
1 pane glass, 36 in. x 13 in.	...	...	...	...	...		0	12 0
Tar, garnets, etc.	...	...	...	...	...			
Labour	...	...	...	...	...	1	3	0
						<hr/>		
						£5 0 0		

**Laying Houses.**—The essential features of these houses are as follows:—They are 30 ft. long x 14 ft. wide, 8 ft. high in

front and 5 ft. at back. No glass or dropping boards are used, and the top half of the front is open but protected by an overhanging hood (*see* Fig. 3). The floor is concreted and the sides and half the front are built of feather-edge boards. For the back, plain  $\frac{1}{2}$ -in. boards are used, and these are covered on the outside by felt to prevent all possibility of draughts on the perched birds. The roof is boarded and covered with felt, though the cost may be lowered by dispensing with the boarding, using felt only. On completion the whole exterior was well treated with a mixture of tar, pitch and lime.

Dropping boards are dispensed with as these entail much labour, and their absence enables the perches to be placed only 18 in. from the floor, and therefore well away from any draught from the eaves. The perches are 3 ft. long and are placed at right angles to the back, over a manure pit. Each house provides accommodation for 100 laying birds, and each of these units is allowed half an acre grass run.

The specification for these houses is as follows:—

	3 in. $\times$ 3 in.		3 in. $\times$ 2 in.		5 in. $\times$ 2 in.	
	No.	Total length.	No.	Total length.		
Front uprights...	4 of 9 ft.	36 ft.	9 of 9 ft.	81 ft.		
Back „ ...	4 „ 6 ft.	24 ft.	9 „ 6 ft.	54 ft.		
Sides and middle uprights ...			10 „ 9 ft.	90 ft.		
Top rafters ...			11 „ 15 ft. 6 in.	170 ft. 6 in.	2 of 16 ft.	32 ft.
					1 „ 8 ft.	8 ft.
Plates...			6 „ 10 ft. 6 in.	63 ft.		
Over door, etc....			1 „ 12 ft.	12 ft.		
		<u>60 ft.</u>		<u>470 ft. 6 in.</u>		<u>40 ft.</u>
Summary						
{ 3 in. by 3 in. 3 in. by 2 in. 5 in. by 2 in. }		Uprights	60 ft.	at 2½d. per foot	0	12 6
		and	470 ft. 6 in.	at 1⅓d. „ „	2	13 10
		Rafters	40 ft.	at 2⅓d. „ „	0	7 11
2 Doors ...	...	90 ft.	1 in. matching	at 26s. 6d. per sq.	0	11 11
Brackets...	...	78 ft.	2 in. by 2 in.	at 1⅓d. per foot	0	7 4
Door stops	...	75 ft.	2 in. by 1 in.	at 1d. „ „	0	6 3
½-in. boards	...	6½ sq.	5 in. by ½ in.	at 15s. per sq.	4	17 6
F.E.B. ..	...	4½ sq.	6 in. by ¾ in.	at 14s. „ „	3	3 0
2 bundles laths	...	1 in. by ¼ in.		at 3s. 6d. each	0	7 0
Perches :						
1 piece	...	6 ft.	4 in. by 2 in.	at 2d. per foot	0	1 0
4 pieces	...	15 ft.	3 in. by 1½ in.	at 1⅓d. per foot	0	8 9
24 pieces	...	3 ft.	2 in. by 1¼ in.	at 1d. „ „	0	6 0
3½ rolls felt	...	84 yd.	24 yd. rolls	at £1 per roll	3	10 0



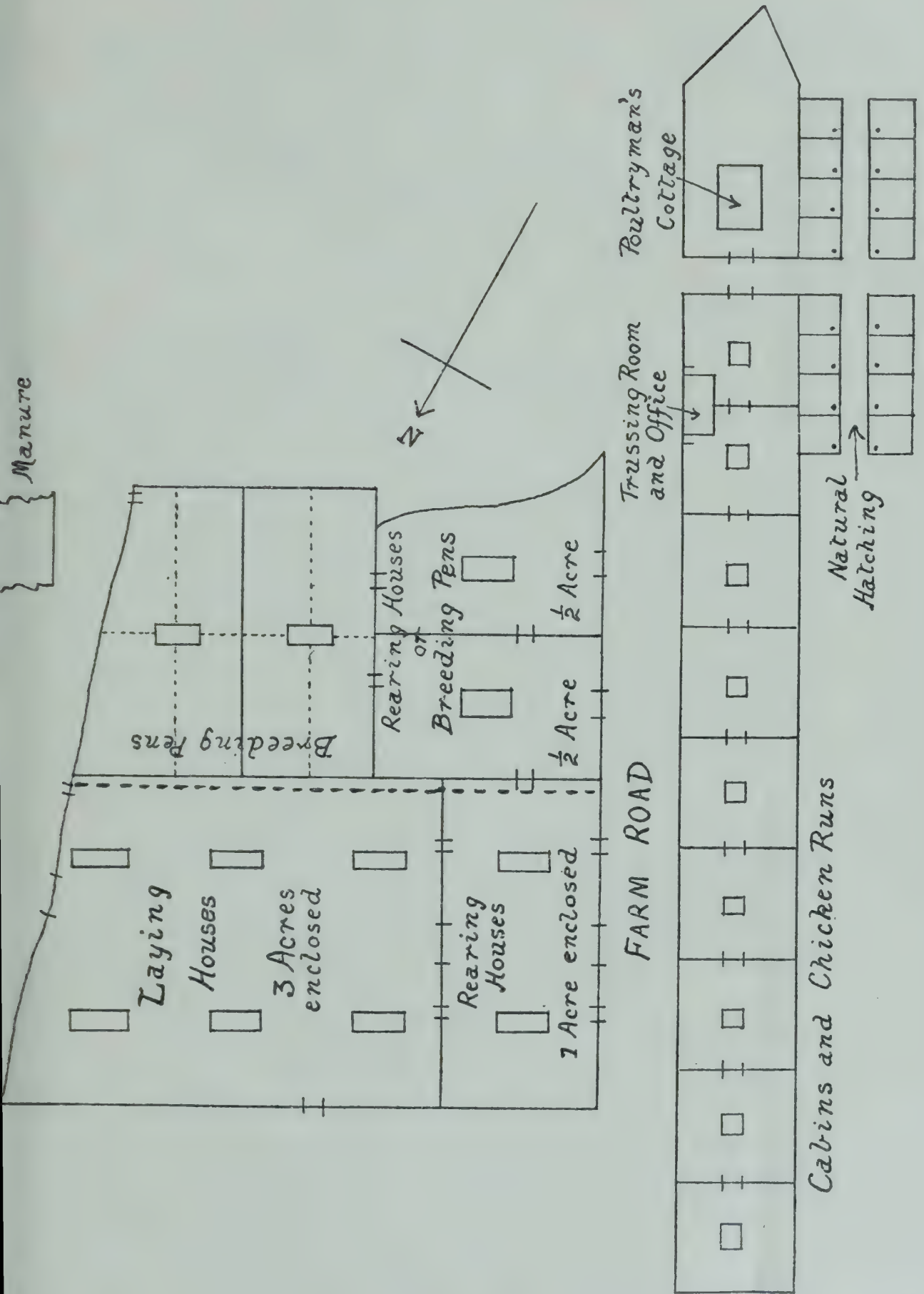


FIG. 4.—Plan showing Lay-out of Poultry Department, Herts Institute of Agriculture.





			£	s.	d.
5 bags cement ... ..	at 4s. per cwt.		2	0	0
30 ft. wire netting 1 in. mesh ... ..			0	12	6
6 gallons tar and pitch, locks, garnets, latches			1	2	0
Front to manure pit 60 ft.	8 in. by 1½ in.	at 2½d. per foot	0	12	6
			£22	0	0
Labour: Two men for a fortnight ... ..			10	0	0
			£32	0	0

In this specification no charge has been made for gravel, which may be obtained locally. By using 2 in. x 2 in. for uprights instead of 3 in. x 2 in. and dispensing with boards under the roof felt the cost could be reduced to £27.

**The Complete Plant.**—The complete plant consists of twelve houses of the type just described under laying houses. Six of these serve as the laying houses proper and are enclosed in one open run which allows half an acre to each house. Two or three houses are used for breeding pens. Each of these is divided into two with a breeding pen in each, and each pen has a double grass run. The other three or four houses are used for rearing. In addition a small three-compartment hut has been erected to provide the poultryman with an office, a trussing room, and a chick food store. A plan showing the lay-out of all the houses is shown in Fig. 4.

It is not intended to keep more pure breeds than the three already mentioned, viz.—Rhode Island Reds, White Wyandottes, and White Leghorns. A number of first crosses will, however, be reared, as apparently, as so often happens with farm animals, the first cross in poultry, if effected in a desirable manner, provides stronger and more profitable birds.

Everything possible has been done to economise in labour. The removal of manure will be done at regular intervals by a horse and cart. Water has been laid on through the department as is shown by the dotted line in the plan.

A plant of this description is perhaps unique. There is nothing superfluous, and it is confidently anticipated that at a later date it will be possible to publish a balance sheet which will prove the soundness of its conception.

The actual cost of building up the poultry plant might be given, but the figures would not apply generally, as in this instance a good deal of home-grown timber was used. The

following figures, however, given an approximate estimate when all the materials are purchased:—

						£	s.	d.
12 houses	...	...	...	...	... at £32	384	0	0
10 cabins	...	...	...	...	... at £5	50	0	0
Wire netting	...	...	...	...	...	80	0	0
Office, trussing room, chick food and egg store	...	...	...	...	...	25	0	0
Incubator room (old building utilised)	...	...	...	...	...	10	0	0
Four incubators	...	...	...	...	...	46	0	0
Coops, etc.	...	...	...	...	...	18	0	0
Laying on water	...	...	...	...	...	12	0	0
Incubator eggs and breeding birds	...	...	...	...	...	120	0	0
Sundries	...	...	...	...	...	25	0	0
Labour	...	...	...	...	...	180	0	0
						£950	0	0

On this basis the cost of setting up an 800-bird poultry plant approximates to 24s per bird when live stock are included, and 20s. per bird exclusive of live stock.

\* \* \* \* \*

## THE PRINCIPLES OF POULTRY FEEDING.

### I.

POULTRY can produce concentrated, palatable and easily digested human food, in the form of eggs and meat, from materials that are frequently unsuitable for other domestic animals and might otherwise be wasted. Waste and surplus vegetable material from the garden and allotment, household scraps, the residue of grain left from the harvest fields and stack-yards, are instances of food materials which the hen is capable of converting into eggs and meat. When given free range, particularly over arable land during cultivation, poultry consume large quantities of grubs and worms, insects and green food, and are known to be valuable agents for the destruction of ground pests. Hence, under suitable conditions and at certain seasons not only will poultry find much of their own food, but will help to keep down destructive insects.

The object of the poultry-keeper is to convert various feeding materials into eggs and meat in the most profitable manner, and therefore some knowledge of the several aspects of the science and practice of feeding is desirable. The functions of food are:—

- (1) To maintain the body of the fowl in normal healthy condition.
- (2) To provide for production, i.e., growth, flesh and eggs.



In order to maintain the body of a healthy adult fowl in normal condition, *i.e.*, without gain or loss of weight, food is required to keep up the heat of the body, to provide energy for digestion and the movements of the various active organs of the body such as the heart, lungs, intestines, etc., and to repair the waste of body tissue which is constantly going on even in the body of a resting and unproductive animal. If only sufficient food for maintenance is given to the fowl, few eggs and no additional flesh can be produced. For production, additional food must be supplied, and if rapid and constant production is required, the supply of food must be not only liberal but of a suitable character and be supplied under suitable conditions.

The value to the poultry-keeper of any feeding stuff depends mainly on the following factors:—

- (1) Composition.
- (2) Digestibility.
- (3) Mechanical condition.
- (4) Value in comparison with other feeding stuffs.
- (5) Class of stock to be fed and the object in view.

**Composition of Feeding Stuff.**—Every feeding stuff consists of various chemical constituents, but as several of these constituents possess similar nutritive values, they are for practical purposes classified into groups. The principal of these groups are:—

- (1) Proteids.\*
- (2) Carbo-hydrates, *i.e.*, starch, sugar, fibre, &c.
- (3) Oils and fats.
- (4) Mineral matter.
- (5) Water.

**Proteids.**—The proteids are a vitally important food constituent. They are essential for the maintenance of the fowl and for all forms of production. Whilst under certain conditions proteids can fulfil the functions of the carbo-hydrates and fats, the two latter can never fulfil the functions of proteids. The nutrition of the animal, however, is achieved much more efficiently and economically when all three constituents are supplied in proper proportion. Proteids should never be supplied in excess. Not only are foods rich in proteid the most expensive to purchase, but if unnecessary quantities of proteid are fed to poultry, considerable and unnecessary strain is thrown upon the kidneys and liver in excreting the surplus.

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\* A group of food constituents known as the amides is for the purpose of this article included in the proteid group, to which they are closely allied. They are chiefly found in rank young grass and roots and their functions are not at present thoroughly understood.

*Carbo-hydrates, Oils and Fats.*—These supply the fowl with heat and energy and any surplus consumed beyond what is necessary for this purpose is stored up in the body as fat. Fibre, which is one of the carbo-hydrates, constitutes the outer coat of seeds and is found in the stems and leaves of plants. As the plant ripens this fibre often becomes of a tough woody character and so far as our present knowledge goes, fowls can digest this fibre only to a very small extent; in fact, apart from the necessity of supplying a certain amount of bulk in a poultry ration, it is advisable to eliminate fibre from the poultry ration as far as possible. Oils and fats have a similar function to carbo-hydrates in the body of the fowl and supply heat and energy, but are nearly two and a-half times as efficient in this respect as carbo-hydrates. An excess of fats in the foods should be avoided, however, as otherwise the digestion of the fowl will be affected. On the other hand, the yolk of the egg contains over 33 per cent. of material of a fatty nature and consequently the laying hen must have sufficient fat producing material in her rations.

*Mineral Matter.*—Poultry, especially laying hens, undoubtedly require considerable quantities of mineral salts, particularly those of calcium, such as carbonate of lime. It is probable that growing birds and laying hens are in practice inadequately supplied at times with mineral salts. Growing birds require regular supplies to enable them to grow and to build up their frames. Laying hens, especially those of heavy laying strains, use up considerable quantities of mineral salts in producing their eggs and unless they obtain sufficient supplies in their food, the body tissues are drawn upon and the healthy equilibrium of the body is disturbed. It is probable that fowls can absorb mineral salts in an inorganic form, such as for instance, calcium phosphate, magnesium sulphate, etc., but the poultry-keeper will be well advised to include in the poultry rations those feeding stuffs, such as freshly-cut green bone, fish meal, meat meal, skimmed milk, etc., and fresh green stuffs, which are rich in mineral salts. The use of such feeding stuffs in proper proportions will not only ensure a sufficient supply of mineral salts, but also of the much discussed accessory food factors, the vitamins. Cod liver oil is rich in the vitamin known as Fat Soluble A, and is often used in the poultry ration for this reason at the rate of a teaspoonful to every pound of the food. It is particularly useful for growing chicks and for hens producing eggs for hatching purposes.



*Water.*—All foods, even the driest feeding stuff, contain more or less water, while turnips may contain as much as 92 per cent. From the chemical point of view this water has no more food value than ordinary water which is taken in the usual way. A succulent food such as fresh clover, however, is probably of more value to the hen than dried clover meal.

*Use of Tables.*—The table to follow at the end of this article shows the chemical composition of most of the feeding stuffs used by poultry-keepers. This table will enable the poultry-keeper to determine whether a feeding stuff is rich or deficient in one or more of the essential food constituents. For example, maize is seen to be fairly rich in fat and carbo-hydrates, but somewhat deficient in proteid; oats are a better balanced feeding stuff than maize, whilst meat meal, fish meal, dried yeast and maize gluten meal are seen to contain high percentages of proteid. Dried yeast is also rich in mineral salts. An unusually high percentage of ash or mineral salts shown on analysis of a *manufactured* feeding stuff, however, often indicates the presence of dirt or sand.

**Digestibility of Food Stuffs.**—There is little use in giving feeding stuffs which the birds cannot easily digest. Such efforts are demanded from the digestive organs of the modern layer, which is expected to produce upwards of 200 eggs in the year, that if the food given to her places too great a tax on her digestive energies, or if the nutriment contained in the food is insufficient, a high egg yield is impossible. The foods used should be palatable and easily digested in addition to being nutritious. Unfortunately very little reliable knowledge based on scientific investigation is yet available regarding the digestive powers of poultry. Such knowledge as is available, however, indicates that the capacity of poultry for digesting the various feeding stuffs in common use approximates more closely to that of the pig than of other farm animals. Apparently poultry can obtain little nutriment from crude fibre such as the husk of oats, or the fibrous portions of cut clover prepared from plants past the flowering stage. Maize and maize meal appear to be more digestible than either wheat or oats, and there is considerable evidence to indicate that maize is a most valuable grain for poultry when combined with foods rich in proteids and some bulky material such as cut clover of good quality. The fat in oats is apparently easily digested by fowls, and this is confirmed by the old-established practice of using Sussex

ground oats for fattening purposes. In spite of the indigestible character of oat husk, Sussex ground oats are found in practice to be one of the most valuable foods for general use. The scanty scientific information available on this subject emphasises the need for further reliable scientific investigation into the digestive capabilities of poultry. The commercial importance of the science of poultry-feeding is obvious. It is just as important as a knowledge of the heat-producing values of various fuels is to the engineer and to the owners of steam engines. In the meantime, the poultry-keeper should be guided in his feeding methods by the best modern practice, bearing in mind any advantages offered by locally produced feeding stuffs, seasonal supplies and variations in market prices, and should keep an alert eye open for any new information which may result from further scientific investigation.

The table given in Part II shows not only the chemical constituents of the various feeding stuffs, but also the percentage of digestible nutrients. The latter percentages are based on direct experiments with quadrupeds, including pigs, and although further scientific investigation may show that these percentages are not quite accurate for poultry, they probably constitute in the meantime the best guide available. Thus it is seen in the case of oats that whilst this grain contains 10.3 per cent. of proteid, 8 per cent. only is digestible, but nearly the whole of the fat is digestible and 44.8 per cent. out of 58.2 per cent. of soluble carbo-hydrates. In considering the composition of a feeding stuff, the digestible nutrients are a better guide to the feeding value than the mere chemical analysis, though attention should be paid to the amount of fibre and ash present.

**The Class of Stock to be Fed and the Object in View.**—The natural common sense of the average poultry-keeper will no doubt indicate to him that young chickens require feeding stuffs and methods of feeding different from those suitable for adult laying stock or fattening stock. For example, ducklings intended for consumption when about 10 weeks old may be supplied with some forcing and fattening foods from birth; on the other hand, young pullets required later on to endure the strain of heavy egg production must be fed with the object of building up frame and constitution. Breeding stock too must not be fattened, but maintained in hard, healthy and fairly productive condition. Laying stock during the autumn and winter months will require careful and liberal feeding on



egg-producing foods. These various objectives will necessitate different rations and methods of feeding if commercial success is to be fully achieved.

**Mechanical Condition of Feeding Stuffs.**—The fineness or coarseness of meals, the amount of extraneous matter such as dirt, stones, weed seeds, etc., in samples of grain, the presence of “smutted” grains, obvious adulteration with husks or other worthless material, the colour, smell and taste of a sample may all be regarded as part of the mechanical condition of a feeding stuff and should be carefully observed by the purchaser. Sour or mouldy meals and samples of light husky grain should invariably be rejected.

*(To be concluded.)*

\* \* \* \* \*

## GROWING TURNIP, SWEDE AND MANGOLD SEED IN THE HOLLAND DIVISION OF LINCOLNSHIRE AND ADJOINING DISTRICTS.

THOMAS W. LANE.

CONSIDERABLE acreages of root seeds are grown in Lincolnshire, more especially turnip and swede, in a less degree mangold seed; cabbage and kale seed to a limited extent, and occasionally rape seed. In addition a large acreage of brown and white mustard is grown chiefly for manufacturing purposes, but some white mustard is also grown for seed purposes. The fact that south Lincolnshire is specially adapted for seed growing may be due to several causes, chief of which are the natural richness and deepness of the alluvial soil, proximity to the sea, and the large acreage of rich pasture land broken up during the past few years. As this land cannot be used for corn for several years the choice of crops is almost limited to brown mustard, turnip and swede seed and potatoes. Some farmers object to brown mustard from the fact that it is often extremely difficult to get rid of, and appears as a weed for many years. Turnip and swede seed are not open to the same objection to the same extent.

The writer has no exact information as to the acreage under root seeds. It fluctuates considerably; for instance, in the event of a somewhat general failure, as in 1922, the next season's acreage is above the average, but in normal times it runs to several thousand acres. A large proportion of the produce is

exported. The actual volume of the world's trade in seeds has probably grown during the past few years but competition from Continental growers has increased perhaps in greater ratio, therefore an expansion of the industry is not likely.

It is difficult to estimate cost of production or probable returns. The best and cleanest land is usually chosen, the cost of cutting and thrashing is higher than with corn crops, and planting adds considerably to the expense. The crop is a speculative one, but in a series of years the average returns are perhaps substantially higher than with corn crops.

Probably in relation to other crops there is a higher proportion of swede and turnip seed grown in the Holland division of Lincolnshire than in any other district in the country, and perhaps the largest acreage. The root seed growing area extends beyond the borders on a diminishing scale, but in the outskirts of the seed growing area and on isolated crops it has sometimes been found that larks and wood pigeons destroy or damage crops in the early stages, and linnets take a considerable toll of any surviving crop when in seed. One of the reasons why farmers in this district like to grow some turnip seed is that it provides a change of rotation and is harvested early, between getting the clover hay crop and mustard cutting and corn harvest. The stubble can be ploughed up early and is available for wheat if required. One of the drawbacks of the crop is that in the event of its being a thin or poor plant weeds are very troublesome, the land is left rather foul, and the straw is of little value.

The bulk of the crops is grown for the trade on contract from seed stock provided by the merchant. Stock seed being the produce of selected roots and the seed trade being highly specialised it will be understood that merchants select specially for the requirements of their own particular trade. The industry has created a large body of expert planters and cutters, who are usually paid by piece work—planting by the thousand or by the acre, and cutting by the acre—and earn good wages.

The soil of the district varies from light silt almost to clay, with a small area of black land and skirt land (silt and black mixed). The most generally reliable land for turnip seed is medium or good bodied silt land.

Turnip and swede seed can only be grown successfully even in this district on the best and cleanest land. It must be in good heart and these crops grown only at long intervals. There is nearly always a considerable percentage of crop failures, in some seasons a small percentage only surviving. A thoroughly



prepared seed bed is the first essential for success; errors of cultivation account for some failures—amongst other causes are insufficient preparation of land, especially insufficient rolling, drilling seed too deeply, drilling artificial manure with seed, and drilling too late—but even under apparently perfect management failures occur.

**Turnip Seed.**—It was at one time thought that turnip seed could only be grown satisfactorily on fallows, but it is now taken after almost any crop excepting perhaps white corn. Well mucked fallows, however, remain the best preparation.

The seed is drilled on the flat at the rate of 2 to 3 lb. per acre, usually with four coulter in a drill, and as farmers' drills vary in width the rows vary from about 18 to 23 inches apart. It is usually drilled on rolled work but sometimes after a light harrowing. The seeding period extends from the second week in August to the first week in October, according to the class of land and individual farmers' ideas. The tendency of recent years has been towards late drilling as it has been found that the late drilled crops yield better—perhaps partly because if bulbs are developed they are more tender than plants, and partly because a crop of roots makes more demand on land than small plants and leaves the land lacking in sufficient stamina to finish the seed crop. It may be suggested that on medium soils, in order as far as possible to ensure plants getting strong enough before the winter, yellow turnip should be drilled not later than the 14th September and white turnip by the 21st. but farmers do not usually differentiate sufficiently between the varieties. On freshly broken land later sowing may be desirable and on strong or stiff and black land earlier sowing is indicated, but from the fact that we have not had much winter in recent years, farmers have acquired a habit of late sowing.

In addition to perhaps some fertiliser applied in the autumn it is not unusual to top dress in the spring with up to 2 cwt. of sulphate of ammonia or nitrate of soda.

The crop may require considerable attention in the early stages. In the first place, to keep flea and other pests from damaging or destroying it, as soon as the plant appears it is probably rolled, perhaps horse hoed once or twice, and harrowed between rows in the autumn. It is again hoed and perhaps harrowed in the early spring to destroy small weeds and to free the plants from chickweed. Provided, however, that the crop is free from weeds, very late autumn or very early spring cultivation is not desirable as the crop resents disturbance during

frost. As the season advances it is also cultivated more deeply between the rows from time to time as long as horses can be kept in the crop, and in some cases as a final operation the rows are hilled or moulded up with the object of burying the remaining weeds, chickweed especially, and with a view to holding the plants up and preventing storm damage. This, however, is not a general practice.

In case of gaps in the crops, planting is resorted to for filling in, plants being taken from thicker parts. A very thick plant is sometimes horse-hoed across, but unless it is thick all over the land, hand-hoeing is better. Some farmers do not thin out at all. It cannot be stated definitely that thinning out is best in all circumstances and conditions, but it may be assumed to be advantageous generally, resulting as a rule in stronger plants. The ideal plant perhaps is one that has come regularly and thinly throughout, as these plants are not drawn up, and develop into broad-leaved strong plants, giving a satisfactory yield.

**Swede Seed.**—One advantage of swede seed growing over turnip is that, as it is not planted till November, there is plenty of suitable land available (it is generally taken after potatoes), only a small space being wanted for the plant bed in proportion to the acreage to be planted. The price paid is also higher in consideration of the cost of extra labour involved in planting. Swede seed is a more speculative crop than turnip—the rewards may be greater but so are the risks. Planting subjects it to a severe check and unless conditions are favourable often a considerable number of plants die off. Being slower in growth in all stages it appears more liable to attack by pests.

The usual method in Lincolnshire for swede in contradistinction to turnip seed is to sow the seed on a plant bed any time from about 20th July to 14th August, the general experience being that it should at any rate be sown by the first week in August. It is sometimes broadcast, but usually drilled with a hand drill about 12 inches from row to row, or with a corn drill. the advantage of drilling being convenience in hoeing. Stocky plants are desirable, and if land can be spared it is well to allow one acre plant bed for about 7 acres crop, less of course being wanted for broadcast sowing. At this time of year it is very difficult to obtain a plant if the weather is exceptionally dry, and there may be considerable difficulty in warding off the turnip flea: the mustard bug also is frequently active and troublesome.

The usual allowance of stock seed is 2 lb. per acre, which in favourable circumstances would provide plants far in excess of requirements, but contingencies have to be considered.



Planting is done from early November to February, as circumstances permit, but owing to the large acreage in potatoes in this district, farmers are frequently much occupied in lifting these until late, and only a small proportion of swede is planted in November. The advantages of early planting are considerable: the plants recover from the check and become established before winter and in consequence get a quicker and better start in the spring. Given sufficient moisture in the land for the plants to strike root they would probably be better planted in October. If left too long on the bed they are apt to be drawn up, and if there is much chickweed, etc., may be weakened or choked out of existence.

Swedes are planted in rows from about 24 to 28 inches apart with about 6 to 12 inches from plant to plant, according to individual predilection. In this district planting is done with a tool resembling a shortened miniature spade, but a few planters use a dib. It is a good but not sufficiently followed practice to shorten roots before planting so that there are no long ends to double up. It may be argued in support of close planting that there is always a prospect of a proportion dying off. In favourable conditions the wider planting may be found to give the best average results, but there appears to be no golden rule in the matter as either on occasion yields heavily or the reverse.

Planting takes place either on land harrowed down and marked, out or in the furrow seams, according to the character or condition of the soil. Plants are occasionally ploughed in but this practice is not to be recommended. Rolling is often done after planting and again in the spring, especially if the land is found light. It is a fairly general practice to cut back swedes, especially if they are weak, to encourage spread of plant.

Swede seed is occasionally drilled to stand. In this case it is usually drilled later than for plants, perhaps late in August. The land has to be particularly clean for a drilled crop as it occupies the land for nearly twelve months: it is therefore mostly drilled on fallows and on fairly heavy land which is not much subject to annual weeds. On the average perhaps planting gives better results, although on occasions a drilled crop may come into bloom earlier and get away from the ravages of the turnip flower beetle. There is, however, a prejudice in the trade in favour of planted swedes. Hilling or moulding up is practised more with swedes than with turnips. Some fertiliser may be applied in the autumn, and in addition swedes require and are nearly always given in the spring a generous top dressing of sulphate of ammonia or nitrate of soda.

**General Notes on Turnip and Swede Seed Crops.**—The following observations apply generally to both the turnip and swede seed crops. It is desirable to grow different varieties well apart as there is a risk of natural cross fertilisation (especially with some varieties), producing undesired results. When in bloom the crops are rogued, *i.e.*, the false plants, which are distinguished from the true plant by a difference in colour of the flower, are removed. This is done by, or under the direction of men of experience, employed by the merchants contracting, or by their agents.

Seed should be thoroughly fit before cutting; it is sometimes diminished in yield and value by premature cutting, but the greatest danger is in premature stacking which may result in making seed useless for growing purposes.

Seed cutting commences in forward seasons with early varieties of turnip towards the end of June and with swede perhaps the end of July. It is cut by hand and tied with string and left usually for over a week in the field. The sheaves are laid lightly on the stubble and turned after weathering for a day or two, and in the event of rain are again turned or lifted. Showery weather after cutting does not damage the seed to any extent if it is turned or lifted. The custom is to lay the sheaves with heads to the north-east, most of the strong winds being expected from the south-west. In loading and carting, the crop has to be carefully handled to avoid waste of seed. It is usually put in small stacks to prevent heating and cloths are placed on the steddles to preserve seed which spills out freely when handling. Seed is occasionally thrashed "out of the field," in which case it has to remain longer in the field than when stacked. If stacked, turnip seed must stay in the stack fully six weeks, longer is desirable, and swede takes more time to condition.

The seed has to be very carefully thrashed (especially swede seed) to avoid damage, but machine owners in this district are experienced in the matter and on the whole do exercise care. One difficulty, however, is for farmers to obtain machines when wanted, and delivery of seed is often delayed. The average yield of turnip and swede seed is roughly about 24 bushels an acre, but on the best or new lands sometimes considerably more. Those, however, who attempt to grow either crop on moderate land are doomed to disappointment.

**Mangold Seed.**—Although this district is possibly better adapted for the production of swede and turnip seed than any other it cannot be claimed that it is so well suited in all respects for mangold seed and this is not grown to the same extent.



The trade place a proportion of their requirements here as a provision in case of failure of crops in other districts. It is seldom that crops fail altogether in this district, but better samples may be produced on drier soils and in other districts in some seasons.

As contrasted with swede and turnip seed new or extra rich land is not to be desired for mangold seed, which frequently fails to ripen early enough but persists in growing on. The land requires to be clean as mangold seed is a late crop. Stiff or heavy land usually produces the best seed and it holds crops up better. The crop is generally hilled up as it has not much root hold. As mangold seed is liable to natural cross fertilisation, varieties, and crops of different colour especially, should be grown well apart.

The usual method is to sow seeds in a plant bed about the first week in August and plant out in the autumn or spring. It is perhaps more common to plant in spring because it is thought that the plants on the beds are better protected from frost. If planted in the autumn there may be considerable losses, while if losses occur it is better to have them in the bed than in the field. On the other hand the autumn planted may come to hand slightly earlier, which is an advantage. The plants are usually set in rows about 27 inches apart and about 8 to 12 inches from plant to plant, sometimes wider. It is now an increasing practice to top plants when beginning to run—usually to pinch or take a small piece off the lead with the object of minimising risk of storm damage through the plants getting too tall, and to encourage the spread of laterals. Sometimes the crop is left till later, when the top is cut off with a hook, but this results in the crop being put back, which is not desirable.

The crop is cut by hand, tied in small sheaves, and put into small stooks, and it has to remain in the field for some time before it is fit to be stacked. It is usually put up in small and very narrow stacks and in this district, at least, stacks should always be ventilated. This is neglected at times and in consequence the stacks may heat and seed be rendered useless. Seed is not as a rule ready for threshing before Christmas.

**Insect and Other Pests.**—One cause of the failure of the turnip seed crop in the early stages, especially if the weather is hot and dry, is the turnip flea, and occasionally mustard bugs will clear off crops and are difficult to combat. Slugs are destructive, especially after peas and clover. Larks are destructive in severe weather (in the absence of other green food particularly) as also occasionally are wood pigeons. Chickweed is often very

troublesome to deal with, and if the weather does not permit of frequent cleaning it may smother the plant in its early stages or in the spring.

The turnip flower beetle has also done material damage to turnips and swedes when in bloom, in 1922 especially; hitherto it has not been found to do much damage to turnip seed, although swede has been damaged materially. The usual course of this pest is to start on the earlier varieties of turnip and follow on in succession as crops come into bloom, and then on to swede seed and brown mustard. Some efforts have been made to deal with this pest, usually with poisonous or nauseous washes or powders, but with no marked success. By the time the mischief is evident the crops are so far advanced that it is often impossible for a horse machine to get through them and difficult even for a man with a knapsack sprayer. The crops may recover to some extent but they come to hand later. An early season seems to be favourable to swede. For instance, in 1921, swede crops generally were good, as they got away from their enemies.

For several years past turnip gall weevil attack on swedes has been very marked, but the plants affected have not apparently failed more than clean plants. However, rooks may pull up the plants to get at the grub. One great trouble with swede is what is known locally as "Canker," which does not usually show itself till plants are running to seed and then they begin to break down, and in bad cases nearly all may go, so as to render the crop worthless. A stem maggot is also troublesome at times, although crops much infested have on occasion yielded well (in quick growing seasons).

The various pests affecting root seed crops call for serious investigation, especially perhaps the turnip flower beetle.

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## BLOSSOM WILT OF PLUM TREES.

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THE object of the present note is to call the attention of fruit growers to unsuspected sources of infection for the Brown Rot diseases of fruit trees, particularly with reference to outbreaks of Blossom Wilt of plum trees, caused by *Sclerotinia* (*Monilia*) *cinerea* forma *pruni*.<sup>\*</sup> In certain seasons the Blossom Wilt con-

<sup>\*</sup> For a general account of the Brown Rot diseases caused by this fungus see the Ministry's Leaflet No. 367.





FIG. 1.—Young Branch of Plum Tree Killed-back by Infection through the Flowers.



FIG. 2.—The Flowers (seen in FIG. 1) through which Infection occurred ; the Fructifications of the Fungus are present on the Flower-stalks.





dition assumes serious proportions, for not only are the flowers themselves destroyed but the fungus extends from the flowering spurs into the branches, which are killed back. When many of the young branches of a tree are killed in this way, a condition not infrequent on some varieties of plums, the brown withered flowers and leaves give the tree a noticeably "blighted" appearance.

The chief sources of infection for the primary outbreaks of the brown rot diseases on plum and cherry trees are the mummified fruits which are allowed to stay on the trees through the winter. Serious outbreaks of blossom wilt, however, may occur when there are no "mummies" in the immediate neighbourhood. In the case of the blossom wilt disease of apple trees,\* caused by another specialised form of *Sclerotinia cinerea*, it has been shown that the sources of infection are the spore pustules which develop on the spurs killed the previous year and on the cankers. So also in the blossom wilt of plum trees serious outbreaks sometimes occur in the absence of mummified fruits and can be traced to cankers, dead twigs and spurs.

A case in point came under the writer's notice early in May this year. In a plantation of plum trees of three varieties, viz., Giant Prune, Czar, and Purple Egg, the Giant Prunes all showed a number of young branches killed back from the tip for a distance varying from about six inches to over a foot (Fig. 1), while the other two varieties were almost free from such damage. A close examination of the infected branches showed that at the lower end of every dead portion there was a flowering spur on which the flowers (through which the infection had occurred) were brown and withered, and usually bore grey tufts consisting of chains of spores produced by the fungus (Fig. 2). No mummified plums were to be found at all in the plantation, for care had been taken to remove from the trees, during the winter, all obvious sources of infection, and the nearest trees bearing "mummies" were too far away to account for the extent of the outbreak. A careful search on the trees, however, showed that here and there old dead twigs were present which had been killed by the brown rot fungus in the previous season, and had been overlooked when the rest of the dead wood had been cut out; these had produced spore pustules during the winter, and the numerous spores to which they gave rise served to infect the flowers as they opened. It was observed that the blossom

\* See this *Journal*, Vol. XXIV, No. 5, August, 1917, pp. 504-513, and Leaflet No. 312.

wilt was most intense in the immediate vicinity of such dead twigs.

Now it is to be noted that the blossom wilt fungus of plum trees not only infects the flowers but also the young leaves and the fruit. When the leaves become infected the young shoots are killed, giving rise to the "Wither Tip"\* condition when the leading shoots are killed, and to what has been termed "Shoot Wilt"† when the short lateral shoots become infected, in which case cankers usually arise on the branches. These cankers and dead shoots in their turn serve as further sources of infection. The fruit may become infected not only when ripening but also when in the green growing state.

It is obvious, therefore, that, if at all practicable, the dead branches resulting from an attack of blossom wilt should be removed *as soon as possible*,‡ and for two reasons: (1) The dead flowers serve as sources of infection for the leaves and fruit; (2) if the dead parts are removed early when the contrast between the dead and the living parts is striking, there is less likelihood of portions being overlooked as will almost certainly occur if the operation is left over until the winter.

After a severe infestation of brown rot the precaution should be taken of examining the trees again during the following winter and removing all mummied fruit and dead twigs and branches. It is sometimes almost impossible, however, to remove all sources of infection owing to the fact that fruit spurs and young lateral shoots are sometimes killed without the disease extending into the branches, and such small spots of infection, since they do not produce any conspicuous die-back, evade detection, especially in winter. An extra precaution to minimise the possibility of infection from such sources is to spray with the winter wash recommended for the brown rot diseases,§ viz., one containing 1 per cent. of soft soap and 1 per cent. of caustic soda, to be applied as late as possible but before there is any risk of injury to the opening buds.

Growers of cherries are reminded that the fungus which is responsible for these brown rot diseases of plum trees also causes blossom wilt and fruit rot of sweet cherries, and where plum

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\* Wormald, H. A. "Wither Tip" of Plum Trees. *Ann. Appl. Biol.*, Vol. V, No. 1, July, 1918, pp. 28-59.

† A Shoot Wilt and Canker of Plum Trees caused by *Sclerotinia cinerea*. *Annals of Botany*, Vol. XXXVI, No. 143, July, 1922, pp. 305-320.

‡ In the plantation referred to, the grower, realising the circumstances of the case, promptly set men to work cutting out the dead wood and all was removed during the second week in May.

§ See Leaflet No. 367.



trees are interplanted between rows of valuable standard cherry trees they may prove a menace to the latter unless careful attention is given to keep them free from the brown rot fungus.

\* \* \* \* \*

## WART DISEASE OF POTATOES ORDER OF 1923.

THE Ministry has given serious consideration to the question of what further steps can be taken to arrest the spread of Wart Disease in England and Wales, and on the strong recommendation of its Potato Advisory Committee, supported by the Agricultural Advisory Committee, has issued the above Order, the chief object of which is to secure that growers shall be able to obtain seed potatoes free from infection.

The Order\* revokes the previously existing Orders on the subject, and all growers of potatoes and all potato merchants and seedsmen are asked to make themselves familiar with the new requirements, the chief of which are summarised below.

(1) **Procedure in Cases of Outbreak of the Disease.**—The appearance of the disease on any land in England and Wales must at once be reported to the Ministry even though the presence of disease on that land has been reported in a previous year. Directions as to the measures to be taken by the occupier of the premises will be given by an Inspector.

Potatoes visibly affected with Wart Disease must not be sold or offered for sale for any purpose.

(2) **Restrictions on Planting Potatoes in Infected Land.**—In land on which Wart Disease has been known to exist at any time, the only potatoes which may be planted are those stocks of approved immune varieties which have been inspected while growing and officially certified as being true to type. (See also paragraph 4 as to general restrictions on planting.) A grower may, however, plant potatoes of approved immune varieties which have been saved by him from his previous year's crop on the same land.

A list of approved immune varieties may be obtained on application from the Ministry.

(3) **Infected Areas.**—The Order declares as an "Infected Area" the whole of Wales, the counties of Monmouth, Chester and Stafford, the whole of the county of Lancaster south of the River Ribble, together with Preston and Fulwood, North Salop, Birmingham and Sutton Coldfield, and certain parishes

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\* Copies and any further information may be obtained from the Ministry.

in the counties of Worcester and Derby. Several parishes which were certified under previous Orders, still remain Infected Areas. In addition, the provisions of previous Orders as to Infected Areas were applied to many groups of allotments and to a large number of premises, and these also are all Infected Areas under the present Order.

No potatoes grown in an Infected Area may be moved or consigned to any place in England and Wales which is not in an Infected Area. An exception to this rule is, however, made in the case of ware potatoes of approved immune varieties provided that a statement is made on the invoice or sale note relating to the consignment or in a label or ticket inserted in or attached to the package containing the potatoes, to the effect that the potatoes are of an approved immune variety, that they were grown in an Infected Area, and that they are not intended for planting. Any person receiving potatoes consigned from an Infected Area without this statement must notify the Ministry of the fact within seven days, and must not part with or plant the potatoes without the permission of the Ministry.

**(4) Restrictions on Planting Potatoes and on the Sale of Potatoes for Planting.**—The Order requires that all potatoes planted or sold for planting must have been officially certified either as having been grown on land free from Wart Disease, or as having been inspected and found to be free from the disease, or as being of an approved immune variety true to type. As regards seed grown in England and Wales, the certificates will be issued by the Ministry. The necessary inspections may be made by an Inspector of the Ministry or by some competent person previously approved by the Ministry. For Scotch seed the certificates will be issued by the Board of Agriculture for Scotland, and for Irish seed by the respective Ministries of Agriculture in Ireland.

When potatoes are sold for planting the seller must furnish the buyer with the number of the certificate relating to the potatoes sold. In order to assist both buyers and sellers of potatoes, it has been arranged that the certificate numbers shall have prefixes as follows:—

C.L. (= clean land) for potatoes grown in clean districts or from crops which have been inspected and no disease found.

T.S. (= true stocks) for approved immune varieties which have been inspected and found to be true to type.

The letter A will be used in addition for potatoes grown in an Infected Area, and the certificate numbers for such potatoes will thus have the prefixes A.C.L. or A.T.S.



The following simple but important directions should be carefully remembered when purchasing seed potatoes, whether of English, Scotch or Irish origin, in future :—

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|--|---|
| (a) When buying potatoes for planting in infected soil.  | } The certificate No. must be T.S.....; or A.T.S. |
| (b) When buying potatoes for planting in clean soil in an infected area.   |   |
| (c) When buying potatoes for planting in land which is not in an Infected Area and on which the disease has never appeared.* | } C.L.....; or T.S.....                           |
|  |   |

Certificates, however, will not be required by a grower who wishes to plant seed saved from the crop grown in the previous year on the same premises.

Potatoes grown outside Great Britain and Ireland must not be planted or be sold for planting in England and Wales except under a licence from the Ministry.

(5) **Arrangements for Issue of Certificates.**—Growers who intend to sell seed potatoes must make early application to the Ministry for the necessary certificates. Growers of immune varieties should apply for inspection of their crops whilst growing in order that they may obtain the certificate necessary to enable the potatoes to be planted in infected soil. If the crop is not inspected only a “C.L.” or “A.C.L.” certificate can be issued. It will be necessary in districts in and near Infected Areas for crops of susceptible varieties also to be inspected before a “C.L.” or “A.C.L.” certificate can be issued.

The Ministry will be prepared to arrange for the necessary inspections; the fee for inspection will be 2s. 6d. per acre or part of an acre. No charge will be made for the issue of certificates where no inspection by the Ministry's officers is entailed.

(6) **Restrictions on the Sale of Scotch and Irish “Ware” Potatoes.**—Purchasers of Scotch ware potatoes must obtain, either from the grower of the potatoes or the person in Scotland from whom they are purchasing, a statement, either that the potatoes were not grown in an Infected Area in Scotland, or that the potatoes are of an approved immune variety, or that the crop has been officially inspected and that Wart Disease was not found to exist thereon. This requirement does not apply to potatoes from Scotland sold within an Infected Area in England and Wales.

In the case of Irish ware potatoes the statement must be

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\* Potatoes with certificates bearing a number prefixed by A.C.L. or A.T.S. must on no account be planted in such land.

either that the potatoes are of an approved immune variety or that they were grown on land believed by the relative Ministry of Agriculture to be free from Wart Disease. This requirement also does not apply to potatoes from Ireland sold within an Infected Area in England and Wales.

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## MONTHLY NOTES ON FEEDING STUFFS.

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**Soft, Oily Bacon—Its Cause and Prevention.**—In the June issue of the *Journal*, an interesting hypothesis has been developed as to the cause and prevention of soft, oily bacon. In that article the theory is developed that the main causes of oily bacon are (1) excessive oil in the diet, and (2) the chemical nature of the oil itself. The theory has been put forward after an investigation of cases which have occurred in bacon factories of pigs which, on curing for bacon, were found to produce soft, oily sides. It is therefore important to realise that the deductions made by the writer of the article and the figures indicating the “softening power” of various foods are only tentative and still require to be proved before being accepted by the general farming community as sound. The article is, however, of value in indicating the need for further research in this subject, and as showing that, however skilful a bacon curer may be, his knowledge is useless unless the feeder provides the right raw material for him to work upon.

In consequence of the views expressed in the article referred to, it may perhaps be advisable at this stage to summarise such facts as are already known with regard to the production of body fat.

(1) The chemical composition of the natural body fat of animals varies with the species and the environment. The body fat of most species of animals consists chiefly of varying admixtures of palmitin, stearin and olein, the first two fats being solid at ordinary temperature, while olein is liquid.

(2) Fats can be built up by the animal body from all three foodstuffs, *i.e.*, proteins, fats and carbo-hydrates. As far as the writer is aware there is no preferential storage of body fat from fats originating from any of these three main classes of foodstuffs.



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.						
	s.	lb.	s.	£ s.	£ s.	£ s.	£ s.	s.	d.	
Wheat, British -	—	—	11/3	11 5	0 18	10 7	71 6	2/11		1 56
Barley, British Feeding	—	—	9/3	9 5	0 14	8 11	71	2/5		1 29
„ Danubian „	30/-	400	8/5	8 8	0 14	7 14	71	2/2		1 16
„ Persian „	27/3	„	7/8	7 13	0 14	6 19	71	1/11		1 03
Oats, English White -	—	—	11/6	11 10	0 16	10 14	59 5	3/7		1 92
„ „ Black & Grey	—	—	11/-	11 0	0 16	10 4	59 5	3/5		1 83
„ Scotch White	—	—	12/8	12 13	0 16	11 17	59 5	4/-		2 14
„ Canadian No. 2	—	—	—	—	—	—	—	—		—
„ Western	29/9	320	10/5	10 8	0 16	9 12	59 5	3/3		1 74
„ No. 3 „	28/9	„	10/1	10 2	0 16	9 6	59 5	3/2		1 70
„ Feed	26/6	„	9/3	9 5	0 16	8 9	59 5	2/10		1 52
„ American -	25/-	„	8/9	8 15	0 16	7 19	59 5	2/8		1 43
„ Argentine -	24/-	„	8/5	8 8	0 16	7 12	59 5	2/7		1 38
Maize, American -	39/-	480	9/1	9 2	0 15	8 7	81	2/1		1 12
„ Argentine -	39/6	„	9/3	9 5	0 15	8 10	81	2/1		1 12
Beans, English Winter	—	—	10/6	10 10	1 17	8 13	67	2/7		1 38
„ Rangoon -	—	—	8/3	8 5	1 17	6 8	67	1/11		1 03
Millers' offals—										
„ Bran, British -	—	—	—	6 0	1 10	4 10	45	2/0		1 07
„ Broad -	—	—	—	7 15	1 10	6 5	45	2/9		1 47
Fine middlings (Im-	—	—	—	8 10	1 5	7 5	72	2/-		1 07
ported) -	—	—	—	—	—	—	—	—		—
Coarse middlings	—	—	—	7 15	1 5	6 10	61	2/-		1 07
(British) -	—	—	—	—	—	—	—	—		—
Pollards (Imported)	—	—	—	6 7	1 10	4 17	60	1/7		0 5
Barley Meal -	—	—	—	9 12	0 14	8 18	71	2/3		1 34
Maize -	—	—	—	10 5	0 15	9 10	81	2/4		1 25
„ Germ Meal -	—	—	—	8 7	1 2	7 5	85 3	1/8		0 89
„ Gluten-feed	—	—	—	8 15	1 12	7 3	75 6	1/11		1 03
Locust Bean Meal	—	—	—	8 0	0 11	7 9	71 4	2/1		1 12
Bean Meal -	—	—	—	12 7	1 17	10 10	67	3/2		1 70
Fish „ -	—	—	—	16 15	4 18	11 17	53	4/6		2 41
Linseed -	—	—	—	20 7	1 16	18 11	119	3/1		1 65
„ Cake, English	—	—	—	10 5	2 4	8 1	74	2/2		1 16
(9°/o oil)	—	—	—	—	—	—	—	—		—
Cottonseed Cake, English	—	—	—	7 5	2 0	5 5	42	2/6		1 34
(Egyptian	—	—	—	7 0	2 0	5 0	42	2/5		1 29
Seed)	—	—	—	8 7	1 15	6 12	73	1/10		0 98
(5½°/o oil)	—	—	—	5 15*	1 7	4 8	75	1/2		0 62
„ „ Egyptian	—	—	—	4 17	1 8	3 9	71 3	1/-		0 54
(5½°/o oil)	—	—	—	4 15	0 9	4 6	51	1/8		0 89
Coconut Cake (6°/o oil)	—	—	—	6 2	1 7	4 15	49	1/11		1 03
Palm Kernel Cake	—	—	—	5 15	1 7	4 8	49	1/10		0 98
(6°/o oil)	—	—	—	0 19	0 11	0 8	15	0/6		0 26
„ „ Meal	—	—	—	0 15	0 11	0 4	15	0/3		0 13
(2°/o „ )	—	—	—	8 0*	1 19	6 1	13 4	2/10		1 52
Feeding Treacle -	—	—	—	—	—	—	—	—		—
Brewers' grains, dried, ale	—	—	—	—	—	—	—	—		—
„ „ „ porter	—	—	—	—	—	—	—	—		—
„ „ wet, ale	—	—	—	—	—	—	—	—		—
„ „ wet, porter	—	—	—	—	—	—	—	—		—
Malt Culms -	—	—	—	—	—	—	—	—		—

\* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of May and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 5d.; P<sub>2</sub>O<sub>5</sub>, 4s. 3d.; K<sub>2</sub>O, 2s. 10d.

(3) The composition of the body fat can be altered by the nature of the food given, and evidence exists which demonstrates the possibility of the storage in the body of food fat which is otherwise foreign to the organism. This fact has been demonstrated both in the case of the dog and the pig. Lean dogs fed with linseed oil developed fat which differed considerably from the normal body fat, this fat remaining liquid even at 32° F. On the other hand, lean dogs fed on mutton suet produced body fat which remained solid at 112° F. The addition of linseed oil to the diet of selected pigs also led to deposition of soft, oily fat, giving the characteristic smell of linseed oil, and containing substances peculiar to that oil.

There are two trials which the writer would like to see undertaken with pigs intended for bacon production. The first would be a comparison of linseed cake meal and oil extracted linseed cake meal, or maize meal and oil extracted maize meal. The result of such a trial would indicate the extent to which the production of soft fat is dependent upon the nature and amount of the oil present in the food, as apart from the character of the food itself. The second would be a comparison of three feeding stuffs selected from the table given in the article under discussion, one with a high softening power number, one with a medium number, and one with a low softening power number.

#### FARM VALUES.

CROPS.	Value per Ton on Farm.		Manurial Value per Ton.		Food Value per Ton.		Starch Equivalent per 100 lb.	Value per unit S.E.		Market Value per lb. S.E.
	£	s.	£	s.	£	s.		s.	d.	d.
Wheat - - - - -	8	7	0	18	7	9	71·6	2	1	1·12
Oats - - - - -	7	0	0	16	6	4	59·5	2	1	1·12
Barley - - - - -	8	2	0	14	7	8	71·0	2	1	1·12
Potatoes - - - - -	2	1	0	4	1	17	18·0	2	1	1·12
Swedes - - - - -	0	18	0	3	0	15	7·0	2	1	1·12
Mangolds - - - - -	0	16	0	3	0	13	6·0	2	1	1·12
Good Meadow Hay - - - - -	3	16	0	16	3	0	31·0	1	11	1·03
Good Oat Straw - - - - -	2	1	0	8	1	13	17·0	1	11	1·03
Good Clover Hay - - - - -	4	5	1	4	3	1	32·0	1	11	1·03
Vetch and Oat Silage - - - - -	1	16	0	8	1	8	14·0	2	0	1·07

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## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending June 13th.				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ... ..	13.15	13.15	13.10	13. 0	16. 9
„ „ Lime (N. 13 per cent.) ... ..	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
„ „ „ neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	2. 2	3. 4
„ (Pot. 14 per cent.) ... ..	2. 5	2. 1	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.) ... ..	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.) ... ..	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15†	11.15	11. 5	4. 8
Basic Slag (T.P. 35 per cent.) ... ..	...	...	...	3.12§	2. 1
„ „ (T.P. 30 per cent.) ... ..	...	...	...	3. 0§	2. 0
„ „ (T.P. 26 per cent.) ... ..	...	2.10§	...	...	...
„ „ (T.P. 24 per cent.) ... ..	...	2. 6§	2. 7§	...	...
„ „ (T.P. 20-22 per cent.) ... ..	...	2. 3§	...	2. 7§	2. 4
„ „ (T.P. 18 per cent.) ... ..	...	...	2. 0§	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	3.15	2. 2
„ (S.P. 30 per cent.) ... ..	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.) ... ..	9.10	9.10†	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7.10†	7. 0	6.12	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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**Foot-and-Mouth Disease.**—The existence of foot-and-mouth disease was confirmed on 20th June on premises at Skeffling, near Patrington, Hull, in the East Riding of Yorkshire. The slaughter of the affected and in-contact animals was immediately undertaken, and the usual prohibition of movement restrictions were applied to the area within a radius of fifteen miles of the infected premises.

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THE Sixth Volume of the Ministry's Register of Dairy Cattle can be obtained either direct from the Ministry or from H.M.

**The Ministry's  
Register of  
Dairy Cattle.**

Stationery Office. The price of the Volume is 2s. 6d.

Although the Ministry's Milk Recording Scheme is now becoming generally known throughout the country, and the practice of milk recording is being increasingly adopted, apparently few breeders are aware of the existence of the Ministry's Register of Dairy Cattle. It is published annually, and its main object is to assist farmers by bringing to their notice cows which have an authenticated record of proved milk-yielding ability. The Register contains a list of breeders and owners of cows whose yields have been certificated by the Ministry. The standard which a cow must reach before it is eligible for entry in the Register is 8,000 lb. of milk yielded in one milk-recording year, or an average of 6,500 lb. in two or more consecutive milk-recording years. Any cow, moreover, which has yielded not less than 24,000 lb. of milk over a period of three consecutive years, and which has calved at least three times during that period, may be awarded a certificate of merit on application by its owner, and a list of such certificated cows is given in the Register.

An interesting feature of the Sixth Volume is the addition of a Bull Section, which is intended to be of use to farmers who desire to obtain the services of bulls of proved milking strain. Bulls are eligible for this section whose dams and sire's dams have been entered in the Register, or which have two or more daughters so entered.

The current Volume of the Register contains particulars of 1,500 cows representing 14 breeds other than cross-bred cows which have qualified under the conditions outlined above. Of these cows 1,350 qualified for entry on the one-year standard alone. It may be mentioned that only certificated cows are entered in the Register, and that consequently the number of cows contained in the current Volume is only a small proportion of those which would be eligible on their milk yields if their owners had applied for certificates. The Ministry hopes, however, that as the existence of the Register becomes more widely known and its object more generally understood, farmers will avail themselves of the useful information which it contains.

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FRUIT growers are doubtless aware that in order to check the more rapid spread of silver leaf disease, which has done much damage throughout orchards in this country, the Ministry issued an Order in 1919 (Silver Leaf Order of 1919) making it obligatory on growers of plum trees to cut out and destroy all dead plum trees and all dead wood of plum trees before the 1st April in each year. Whilst much dead and infected wood has been destroyed during the last three years, the Ministry has, in virtue of the experience gained and the knowledge of more recent research, deemed it necessary to make some changes in the Order. The matter has been considered by the Ministry's Horticultural Advisory Council, and, on their advice, the Minister has now made a fresh Order known as The Silver Leaf Order of 1923, which came into effect on the 1st June, 1923.

This new Order requires that in future the work of destruction of dead trees and dead wood must be done in the case of apple trees as well as plum trees, and, the date laid down for completion of this work is the 15th July in each year instead of the 1st April.

In addition to these requirements, and apart from the Order, the Ministry strongly recommends growers to cover with anti-fouling paint, white paint, or tar, all wounds of apple and plum trees, whether made by cutting or pruning, or in any other way. Such wounds are particularly susceptible to the entry of the fungus, *Stereum purpureum*, which is the cause of silver leaf, and if they are left exposed there is a great risk of infection.

A copy of the Ministry's leaflet dealing with silver leaf and any further information on this subject that is available may be obtained on application to the Ministry at 10, Whitehall Place, London, S.W.1.

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THE Annual Report of the Horticultural Research Station at Long Ashton, Bristol, contains short accounts of the experimental work which has been carried out at the Station during the year 1922 into problems concerning fruit production. The experiments on the manuring of fruit trees are particularly opportune, for on this subject information is either scanty or entirely lacking. The Long Ashton workers have realised that the fruit tree has two

functions to perform simultaneously, namely, to produce wood growth and to develop a fruit crop. The fruit grower, whilst naturally interested in securing vigorous growth in young trees, is more immediately interested in the production of a heavy crop, and has employed numerous methods of manuring to secure this end. Manuring in spring and in the autumn have been advised and criticised. Nitrogenous manures have been recommended by some and condemned by others; in short the manuring of fruit trees in the past has been a question of groping in the dark. The experimenters have given an account of the way in which trees act when starved of essential chemical elements, and fruit growers will realise the fundamental importance of ascertaining these facts before progress can be made with certainty. The results of these experiments should be read by all fruit growers, as they are very instructive as to the kind of manures that are required, and stimulative of thought as to the need for securing a proper balance of the different kinds.

It has been realised that in addition to manures other factors influence fruit bud formation, and the Report contains an account of the effect of "ringing" and "notching" in causing trees to produce fruit. For many years it has been known that fruit trees too productive of shoot growth could be induced to produce fruit by clamping the trunks with iron springs, and the Station has reported that the process of "ringing" causes a similar crop formation. In the present Report there is an account of an investigation as to the working of these processes.

Bush fruit has not been neglected, and the Report gives an account of work on the nomenclature of raspberries which has been conducted in co-operation with the Horticultural Research Station at East Malling, Kent. The Report shows the confusion existing with regard to raspberry varieties; and fruit growers will look forward with considerable interest to the further reports of this joint work.

The Station started as a National Fruit and Cider Institute, and whilst it has developed its activities in fruit in recent years, its interest and activities in connection with the making of cider have not declined, and there are several accounts dealing with cider. The growers of cider fruits in Worcestershire and Hereford will find it particularly interesting and instructive to read the surveys which have been made of the cider orchards in those two counties; whilst all growers of market varieties of



fruits will be interested to see that the Station has studied the problem, which has been ever present with them, of dealing with the small and culled apples of market varieties for cider purposes. The Report gives an account of the qualities of cider made from Allington Pippin, James Grieve, Lord Derby, Bramley Seedling, and other market varieties, and contrasts the vintage qualities of these ciders with that made from the ordinary cider sorts. Best cider, the Report states, can be made by judicious blending of ciders from vintage varieties, adjusting deficiencies in quality, and exercising control of the fermentation, so that the resultant vintage has the right proportions of acid, sugar and tannin. Market varieties are deficient in tannin, and generally possess too much acid, so that to utilise surplus table fruit to profitable account by conversion into cider, it is necessary to blend with these a proper proportion of vintage kinds, selected to add the qualities which are lacking in ciders from market sorts and balancing where excesses occur. It is a practical problem with which the majority are concerned, and if a successful solution were discovered might lead to the withdrawal of the inferior samples of market fruit from the commercial markets, to the benefit of the whole fruit industry.

Accounts of experimental work on insect pests and diseases of fruit trees are given. There is a full account of the life history and control of the Apple Blossom Weevil, a pest which for many years has caused considerable damage to young fruit blossoms.\* Not the least interesting or important is the work which is being done on the physiology of Leaf Scorch, a trouble which has come much to the fore in recent years in districts where fruit is being grown on light types of soil, such as exist in Norfolk and parts of the west. The problem, apparently, is not an easy one, but the Report shows that the matter is being investigated on somewhat broad lines. It is clear that the absence of potash, as was at one time believed by many, is not the primary cause of this scorch, but that sudden interruptions of the water supply are a more serious factor in inducing its appearance.

The Report of this work is written in a manner which will appeal to the average fruit grower, and should be widely read.

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\* See this *Journal*, October, 1922, p. 637.

THE following account of a pig feeder's experiences in Suffolk has been communicated to the Ministry by Mr. A. W. Oldershaw,

**Green Food  
and Minerals  
for Pigs.**

B.Sc., County Agricultural Organiser for East Suffolk :—

Mr. R. Flatman, of Mellis, who has very successfully practised dry feeding of late, had a litter of pigs born on 1st September, 1922; they were bred at home, the sow being a Large Black, and the boar Large White. The young pigs had access to the dry feeder when quite small and still suckling, and went entirely on to it when taken from the sow. The following mixture was used :—65 per cent. barley meal, 25 per cent. middlings, and 10 per cent. fish meal.

The pigs were kept in an open stock yard, with deep sheds, and the yard was divided into sections by iron hurdles. There was thus a nice comfortable shed for the pigs to go into, whilst they could also go into the open air at will, but they had not access to any soil.

The pigs were on the sow for 8 weeks and did well until 12 weeks old, when the best pigs began to lose the use of their hind legs and became very dull. The hair also began to grow too much.

Mr. Flatman was aware of the research work on animal nutrition which is being conducted at the Rowett Institute at Aberdeen, and at Cambridge University, and he communicated an account of the trouble to these bodies.

As a result of advice given by them he began to give the animals green food, the green tops only of marrow-stem kale, as the pigs would not eat the stems. He also placed in reach of the pigs a mixture of chalk and sifted house cinders—the result of burning half wood and half coal. The treatment began about Christmas time.

The green stuff was eaten well, and the chalk and ashes mixture was also picked up from the trough from time to time. There was a gradual improvement in the symptoms until the pigs were better. They also ceased rooting amongst the manure, etc. In the later stages of fattening the fish meal in the mixture was reduced to 5 per cent., and 10 per cent. of gram substituted.

The first pig was killed on 31st January and weighed 9 stones dead weight; the second, killed about 10th February, weighed 10 st. 7 lb. The remaining nine, killed on 21st February, averaged 9 st. 9 lb. dead weight. In all six out of the eleven pigs were over ten stones at about twenty-five weeks old, which



was not bad considering the set back they had owing to their illness.

Incidentally it is interesting to note that Mr. Flatman finds that the dry system of feeding is very economical in labour. A boy, aged 15, looks after 96 pigs.

There appears to be little doubt that the recovery of the pigs was due to the feeding of green stuff, chalk and ashes, and the whole incident forms an interesting instance of the value to the farmer of recent work on animal nutrition, which has brought out the value of green stuff in supplying necessary vitamins and of an ample supply of mineral substances to rapidly growing animals such as pigs. It is true that in the experiments by Professor White and Mr. Roberts (this *Journal*, April, 1923) the value of green food was not found to be so great as is commonly supposed. Nevertheless, pigs quite commonly suffer from symptoms such as those given above. The cost of supplying the necessary green food is very small and it undoubtedly brings the feeding of the pigs nearer to a state of nature. The chalk and ashes also cost practically nothing, and the fact that the pigs relish them seems to indicate that the minerals supply a natural craving. Pigs grow very rapidly and undoubtedly require a large quantity of mineral matter for their bones, etc. The foods commonly fed to them do not often contain a very large proportion of mineral matter. In a state of nature pigs, by rooting amongst the earth, are probably able to obtain what they require. When shut up in buildings or stock yards they cannot do this, and hence it appears only common sense to supply them with any minerals they will eat.

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## QUESTIONS IN PARLIAMENT.

**Conciliation Committee Agreements.**—In answer to a question asked by Mr. Noel Buxton in the House of Commons, on the 4th June, as to whether the Minister of Agriculture could state when the Bill dealing with the compulsory registration of conciliation committee agreements will be introduced, Sir Robert Sanders replied that he was not yet in a position to make an announcement on the subject.

**Sheep Dipping Order.**—Mr. Westwood asked the Minister of Agriculture in the House of Commons, on the 7th June, if he was aware that, for two years prior to the passing of the Double Dipping (Sheep) Order, 1920, there were 790 outbreaks of sheep scab in the United Kingdom; that, in the

two years since the passing of the Order, there have been 1,440 outbreaks; and that the Order is a costly failure and is causing grave dissatisfaction and great loss to sheep farmers in the South of Scotland; and would he consider the revoking of an Order which has failed in the purpose for which it was enacted?

The *Minister of Agriculture* (*Sir Robert Sanders*) replied:—The reply to the first part of the question is in the affirmative. The increased number of outbreaks merely indicates that more cases of scab are being brought to light, and I cannot agree that the Order has failed in its purpose. As the Sheep Double Dipping Order, 1920, has not been applied to the South of Scotland, I presume the second part of the question must refer to the Regulations which local authorities make for their own protection. While insufficient care in cleansing flocks of scab still persists in certain districts in Wales and Scotland, I should not feel justified in asking these local authorities to withdraw their Regulations. I am aware of the feeling on this matter which exists in the South of Scotland, and I may say that the Ministry is about to issue a fresh Order dealing with sheep scab on lines which I hope will eventually lead to the stamping out of this disease.

**Labelling of Dried Milk.**—Mr. Lamb asked the Minister of Health in the House of Commons on 3rd May, whether his attention had been directed to an advertisement of Milkal, household milk, which is described as machine-skimmed milk from which only the water has been eliminated; and whether, in view of the implied suggestion that only the water has been eliminated and not the butter fat, he would say what action he proposed to take for the protection of the consumer who may not be aware of what is actually removed by the process of machine skimming?

Lord E. Percy (Parliamentary Secretary to the Ministry of Health) replied "Yes, Sir. My right hon. friend's attention has been drawn to the advertisement in question, and he agrees that it is likely to mislead readers as to the nature of the article advertised. He has no power to take action with regard to such advertisements, but he is considering Regulations to provide for the proper labelling of dried milks."

In reply to a further question on 13th June, Mr. Neville Chamberlain, Minister of Health, said that the Regulations were in draft.

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## REPLIES TO CORRESPONDENTS.

**Feeding of Dried Nettles.**—L.P. asks for information as to feeding of nettles to stock.

*Reply*: Stock will not touch fresh nettles, but when dried they have, according to Emil Pott (*Handbuch der tierischen Ernaerhrung*, 1904, I, p. 102), a good effect on the yield of dairy cows and the coats of horses.

According to R. Gouin (*Les Aliments du Bétail*, 1922, p. 67) they should be cut before flowering and allowed to wilt for some little time on the ground, and then given in mixture with some dry fodder to minimise their laxative



effects. He adds that they may be dried, but are then better fed, after being moistened with hot water, with the addition of salt.

**Feeding Brussels Sprout Stems.**—M.O. asks about feeding Brussels sprout stems to stock. .

*Reply* : Brussels sprouts—the entire plant—have been successfully fed to sheep in times of vegetable glut. Stock will consume with relish the leafy parts of the plant but the coarser and more fibrous parts will be avoided, particularly late in the season.

Similarly, in the case of marrow-stem kale\* it is usually found that stock do not much relish the stems after Christmas.

**Eradicating Ground Elder.**—A.Y. asks whether spraying would be of use.

*Reply* : The Ministry does not recommend spraying for the eradication of ground elder.

Constant hoeing of the ground and cutting off the leaves as soon as they appear, as recommended in Leaflet No. 194 for the eradication of coltsfoot, would probably get rid of the weed in the course of a year or two, but to be really useful it must be done frequently.

**Sawdust Manure.**—B.W. asks whether sawdust might be used to soak up liquid manure for application to the land.

*Reply* : Sawdust does not decompose in the soil as readily as straw, and when used on the land it has a tendency to promote the growth of fungi. Where sawdust is used for litter, the resulting manure should preferably be applied to grass land.

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**Leaflets issued by the Ministry.**—Since the date of the list given on page 283 of the June issue of the *Journal*, the following leaflets have been revised.

No. 242.—“Stripe” Disease of Tomatoes.

„ 262.—Tomato Leaf Rust or Mildew.

„ 355.—Growing Wild White Clover and Late-Flowering Red Clover for seed.

*The following new leaflets have been issued.*

No. 397.—White Clover.

„ 398.—Town Refuse as Manure.

*The following leaflets have been re-written.*

No. 151.—Cleanliness in the Dairy.

„ 300.—The Breeding of Utility Pigeons.

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\* For feeding to Poultry, see this *Journal*, May, 1922, p. 177.

## NOTICES OF BOOKS.

**Heredity in Poultry.**—(R. C. Punnett, F.R.S. London: Macmillan & Co., Ltd., 1923, 204 pp., 10/- net.) No one is better qualified to write with authority on heredity than Professor Punnett, and a book by him devoted entirely to heredity in poultry will be welcomed by all interested in the breeding of the fowl. It is to experiments with poultry that we owe much of our fundamental knowledge of Mendelian principles as applied to animals. In particular the illuminating interpretation of "dominance" and "recessiveness" in terms of "presence" and "absence"—first applied to explain the heredity of comb characters in poultry—was the result of experiments involving many thousands of birds carried out by Bateson and Punnett in the early years of the present century. It is safe to say that the genetic analysis of the fowl is more complete than that of any other animal. Nevertheless, the author is careful to point out that our knowledge, extensive as it is, is practically limited to *visible* characters (such as colour of plumage, nature of comb). For example, little is yet known regarding such an important invisible character as fecundity. It is true that Pearl in America advanced the theory that fecundity is mainly a "sex-linked" character—that high egg-laying capacity is passed from father to daughter and from mother to son, but not direct from mother to daughter. The author, however, is of opinion that this theory requires confirmation. Similarly, he questions whether there is any trustworthy evidence that size or shape of egg is transmitted through the male. The investigation of invisible and economic characters generally presents considerable difficulties to the scientist. It is interesting to learn that there is some prospect of such investigations becoming easier, for there is some reason to think that when invisible characters are sex-linked, as they often appear to be, they may be closely associated with visible sex-linked characters. If this should prove to be the case, early advances in knowledge may be hoped for. The book would be improved by tables showing the genetic analysis of each breed of fowl, that is to say, giving particulars of the characters in each breed regarding which precise knowledge is now available.

It may be added that Professor Punnett's work constitutes a valuable text-book on the Mendelian theory generally, and as such should prove of great value to students of Genetics.

**Market Milk.**—(Ernest Kelly and Clarence E. Clement. London: Chapman & Hall, Ltd., 1923, 445 pp., 19/- net.) This book is practical and interesting and should prove of use to a wide circle of readers. The opening chapter dealing with the consumption of milk and dairy products in the United States is of considerable interest, showing the estimated consumption per head of the population to be about 1 pint per day. It is also stated that the number of cows kept, in comparison with the population, has declined steadily from 287 cows per thousand people in 1840 to 218 in 1921.

Sections devoted to milk as a food for adults and infants are of considerable interest. The chapters dealing with bacteriology and the production of milk of a low bacterial count are well written and full of useful data. The latter should be carefully read by all interested in clean milk production, emphasising as it does the necessity of cleanliness in the cowshed, sterilization of utensils and prompt and efficient cooling,



In connection with the organization of milk control, the inspection of dairy farms and town depots is dealt with at some length. The educational features of dairy inspection are of interest, stress being laid on the utility of clean milk competitions as a means of interesting both producer and retailer in clean milk production. Score cards as used by inspectors when inspecting dairy farms and city plants are given. Producers' Co-operative Milk Distributing Organisations receive consideration, the necessity of their establishment, the advantage to producers and methods of financing being fully discussed. Care is taken to point out the essentials without which the formation of Co-operative Societies cannot be undertaken with success.

Chapters on city milk plants, with plans, and on pasteurisation will be of interest to those handling city milk supplies.

As the authors state, no treatment of market milk problems is complete without a discussion of milk prices and the cost of distribution under various headings. Table 95 shows that according to Hibbard and Erdman costs of distribution, *i.e.*, transportation, handling of plant, and delivery, amounted to 49 per cent. of the total cost of production in 1917 in Chicago and other cities. It is evident that the authors have made an exhaustive study of this question, and the student will obtain useful and interesting information from a careful study of these chapters.

The milk trade in all its aspects is dealt with in this book, but we lay it down with a feeling that the authors have been unable to find solutions to the many hard problems with which the trade is faced.

**Landwirtschaftliche Samenkunde.**—(Dr. Ludwig Wittmack. Berlin: Paul Parey, 1922, pp. viii. 581.) This is a second edition of the writer's "Gras- und Kleesamen" published as far back as 1873. After some forty years of teaching, retirement has afforded the leisure to produce what is practically a new book. It is divided into two sections—(1) General, to page 112, and (2) Special, pages 112 to 513. In the former, the trade in agricultural seeds and seed control, with the machinery used in cleaning and the apparatus used in testing are dealt with, and the biology of seeds generally discussed. In the special section the various species are dealt with individually—grasses occupying some hundred pages, and leguminosae about eighty. The more important economic plants are described, notes are added as to pathology and chief countries of origin, and liberal references to literature given. Papers as late as those of Hernfrid Witte on the colour of red clover seeds, and of E. Lindhard on natural and artificial breeding of red clover (both 1921) are noted in the body of the work, while in the "Addenda" dates as recent as 1922 are to be found. The book is well and fully illustrated and should prove of considerable value. There is a full index and an excellent bibliography.

**Die Kultur der Wiesen.**—(4th Edition. Professor W. Strecker. Berlin, 1923, pp. 502); and **Erkennen und Bestimmen der Wiesengräser.**—(9th Edition. Professor W. Strecker. Berlin, 1923, pp. 250.) These two books supplement each other. In the former practically everything involved in the establishment and care of meadows is discussed—clearing, drainage, irrigation and overhead watering, and fencing occupy the first 150 pages. Then follow renovation, laying down to grass and manuring. A chapter on the care of meadows deals with animal and insect pests (a strong plea is put up for the

mole), weeds and methods of cultivation, rolling, harrowing, etc. The last hundred pages comprise harvesting and conservation as hay or silage. The writer is an enthusiast—his motto is "Better grassland, more cattle—more cattle, more manure and consequently better arable." He leans to rotation as opposed to permanent grass as giving scope for the introduction of new and improved varieties.

The smaller book may be described as a manual of grasses. It is, like the larger, fully illustrated, and contains useful tables, grouping the various grasses under such heads as top grasses, bottom grasses and so forth. Specimens of seeds mixtures for meadows and pastures, under various conditions, are given.

**Egg-in-Kums.**—(By "Sonimor." The "Sonimor" Egg Farm, Leek-hampstead, Newbury, Berks, 1923, XV + 120 pp. 43 illus. Price 5/-.) Mr. Hector Morison has here presented a very readable account of the equipment and methods of commercial egg farming in use at the "Sonimor" Egg Farm. He is an enthusiastic advocate of large flocks both for laying stock and chicks, and he explains that the methods advocated in his book apply only to large units. The opinion is expressed that there need be no limit to the size of the flock or houses provided that the building and organisation are right. The author believes that the use of modern labour-saving appliances is justified by the increased efficiency of the attendants and the greater interest which they take in their work. Nine workers do everything on the farm including incubating and chicken rearing. He finds that  $1\frac{1}{2}$  workers per 1,000 adult stock are ample for all purposes.

The farm is run for the sole object of egg production and for this purpose the White Leghorn is strongly recommended.

Descriptions are given of the construction and equipment of the incubator house, brooder house, colony houses, cockerel houses, laying sheds, breeding sheds, and granary. A granary attached to each house to hold one week's supply is found to minimise labour in feeding. These chapters are illustrated with photographs which show clearly the construction, arrangement, and fittings, and plans are given. Two mammoth incubators of 6,000 egg-capacity are installed. The large brooder house accommodates 5,000 chicks in units of 500. A light blue colouring in the brooder house is recommended as a preventive of toe-pecking. The methods employed in incubating and brooding are fully described and many interesting comments are made.

Over 30,000 chicks are hatched each season. The pullets are drafted from the brooder to asbestos colony houses accommodating 150 to 200. They are allowed to perch at once.

Two sizes of laying sheds are in use. The larger ones, housing 1,500 birds, are 400 ft. long and 16 ft. wide: the smaller houses, 160 ft. long by 14 ft. wide, accommodate 500 layers. Each house is built in the centre of a plot of land, the northern portion of the plot being used in summer and the southern in winter. The northern plot is larger because birds are out more in summer than in winter. About an acre of land is allowed to every 500 birds.

Mr. Morison has recently been experimenting with the use of electric light in his pullet houses from dusk to 7.30 p.m. He finds that the extra cost of light is much more than balanced by the increased winter egg-yield. Dry mash is fed to both old and young birds. Interesting chapters are given on



the water supply, egg packing, collecting and storing, and business methods in commercial egg farming.

The stock of adult birds numbers 6,000, made up of 3,000 pullets, 2,000 second season birds, and 1,000 three year olds. Mr. Morison has kept records which show that his pullets will average 150 to 160 eggs per bird per year, second year birds 130 to 135, and third year birds 120 to 125. He maintains that it pays to keep birds at least three years and gives figures in support of this contention. His basis of calculation, however, is 2s. 6d. per dozen in each case and no allowance is made for winter eggs laid by the pullets. It is assumed that anyone farming on a really commercial basis will need at least 2,000 laying stock. The cost of raising this number and purchasing the necessary equipment is estimated at £3,500. Twenty or thirty acres is mentioned as a useful size for a farm and some hints are given on the choice of situation.

This book is a valuable addition to the poultryman's library, which is sorely lacking in books devoted entirely to poultry farming. It is sure to be read with interest by all engaged in egg farming.

**The British Goat Society's Year Book.**—(British Goat Society, 5, Fenchurch Street, E.C.3. Price 1s. 6d.) The third year book of the British Goat Society (Mr. T. Palmer, Honorary Secretary) contains more than twenty articles by well-known goat breeders, as well as articles by medical men, veterinary surgeons and others. There was recently a special importation of goats from the Continent\* and a detailed account is given by Mr. Palmer of the difficulties which were overcome in the search for suitable stock in Holland and Switzerland. Mr. Holmes Pegler gives a history of previous importations in old days, with amusing accounts of how the regulations governing importation were occasionally evaded.

Dealing with the value of goats' milk for children, Dr. Ker Bell says: "When cows' milk is prescribed for bottle feeding it is generally diluted with water, lime water or barley water, and this does not appear necessary in the case of goats' milk, which is soon tolerated undiluted." Dr. W. R. Hadwen in his article on "Malta fever and Goats' Milk" refutes the stigma generally attached to goats' milk in this connection and attributes the decline of fever to removal of insanitary surroundings.

On the veterinary side of goat keeping, Mr. H. Stainton writes on "Sterility" and says that there are three general factors which militate against productiveness in any animal, namely unnatural conditions, inbreeding, and intensive breeding, such as that carried out for the purpose of heavy milk production.

Dr. F. A. E. Crew has carried out research work on "Developmental Intersexuality in the goat" at Edinburgh and gives the results of his investigations. The volume is illustrated with numerous photographs, and contains the Rules and Regulations of the Society and a list of the names and addresses of members.

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\* See this *Journal*, February, 1923, p. 1023.

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# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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AUGUST, 1923.

## NOTES FOR THE MONTH.

At a recent meeting of the Agricultural Advisory Committee for England and Wales, it was agreed that a sub-committee of

**Agricultural  
Advisory  
Committee and  
the Imperial  
Economic  
Conference.**

that body, consisting of Lord Bledisloe, Mr. J. T. McLaren, Mr. R. R. Robbins, Mr. W. R. Smith, and Mr. C. D. Thompson, with power to co-opt two other members representing the Agricultural Committee of the House of Commons, should be appointed to advise the Minister

on matters affecting agriculture which may arise at the Imperial Economic Conference to be held in London in the autumn. The committee held its first meeting yesterday, with the Right Hon. Sir Robert Sanders, M.P., Minister of Agriculture, in the chair. The two representatives appointed by the Agricultural Committee of the House of Commons are Captain the Right Hon. E. G. Pretyma, M.P., and Mr. Percy Hurd, M.P.

\* \* \* \* \*

THERE is, of course, no place where such a fine display of British cattle is to be seen as at the Royal Show. As an exhibi-

**The Royal Show  
at Newcastle.**

tion this year's show was as wonderful as ever. It is true that in some sections the numbers were small, and, as is usually the

case, there was considerable variation in merit in the exhibits in some of the classes. As is also usual, however, the general standard of quality was high, and, as always, there were in most sections some cattle of a merit scarcely to be excelled. The standard in this country is a high one, and it is hardly necessary to say that it was in every sense maintained by those who had been appointed for the Show at Newcastle to the distinguished, but often difficult, office of making the awards. Here and there could be seen what a judge would regard as common, though not inferior, but there was also to be noted the perfection of form and grace of outline that are the delight of

the breeder's eye as well as that of the mere spectator, whose point of view may be far different.

There are many points that strike the observer at any Royal Show, and it is not, of course, the same points that strike all. This year, one feature of the Show was the great display of Shorthorns, including Dairy Shorthorn, and of British Friesians. The counties of Northumberland and Durham are indissolubly associated with the Shorthorn from its earliest history, and visitors to the Show, no doubt, expected to see the famous breed appearing in force in the country of its origin. They did not perhaps expect to see such a show of Friesians, and many of them must have been surprised by the display that was made by this breed. Numerically, the Friesians came next to the Shorthorns, a remarkable testimony to the present popularity of the breed, and, when it is remembered that at the previous Royal Show at Newcastle the breed was not represented at all, it is a no less striking comment on the rapidity with which Friesian cattle have won favour with breeders in this country.

Another feature that attracted attention was the improvement in both Dairy Shorthorns and Friesians in the direction of greater uniformity of type and the dual-purpose character of that type. Improvement in this sense is perhaps a matter on which there may be a wide difference of opinion. To the breeder anxious to possess a cow that is a good milker, but who has to cater for the store cattle market with yearlings that show promise of growing into weighty, well-fleshed steers, it is unquestionable that the type of Dairy Shorthorn exhibited a few years ago left much to be desired. So it was also with many of the early Friesians. Now, in both breeds and among both males and females, there is a noticeable change in conformation, though not yet uniform, which seems to indicate a definite trend towards the breeding of a type of animal, which, having a high milk record, will also prove useful to the grazier. Experience has shown that there is no reason why a cow that is a good milker should not also be a good-looking one. For the ordinary farmer, a general-purpose breed is the most likely to retain favour permanently, and the present tendency in these two breeds, which are singled out for mention here for the simple reason that they were the most numerous represented at the Show, is as interesting as it is significant. Two other breeds, for which a general-utility character has always been claimed, that showed themselves to such advantage as to be remarked upon at the Show were the Lincoln Reds and the Red Polls.



The visitor who attends the Royal Show with the object of seeing the high standard of excellence to which British breeds of cattle have generally attained, found this year, as always, much in all classes, no doubt, to impress him. To the observer of tendencies in the development of breeds, it may perhaps be said that the most striking feature of the cattle section was the direction in which the improvement of two well-known milking breeds is tending and the remarkable uniformity of type which that tendency is producing.

The poultry section at the Royal Show is always good, and was up to its normal standard this year. A new note in recent shows has been the rabbit section, undoubtedly due to the now fashionable use of the finer self-coloured rabbit furs in place of the dyed and treated commoner types sold under various trade names.

A huge collection of agricultural machinery and implements, seeds, fertilisers, buildings and other farm requisites, would provide any farmer with a choice suitable for any conditions or any climate or soil, and formed a most impressive display.

In regard to agricultural and rural education the remoteness of Newcastle from the southern parts of England doubtless led to a much smaller exhibit than usual. In the agricultural education building the Meteorological Office seemed to be very popular with visitors, and indeed it had a good deal to show. The Agricultural Education Association showed how it endeavours to forward agricultural education; and the Fur Board dealt with inquiries in regard to the rabbit fur industry, showing a variety of fur products. The principal space, however, in this section was devoted to the Agricultural Department of Armstrong College, which had a very full exhibit. In one bay were shown various specimens in connection with the management of grass land. Turves cut from the experimental plot at Cockle Park proved a source of great interest to a large percentage of the visitors, and many comments were made on the striking effect of finely-ground mineral phosphates on grass land lying on a poor clay soil.

In a second bay various specimens were shown in connection with animal husbandry, and a set of hides lent by the Newcastle Hides Improvement Society, showing the damage done by warble fly, attracted much attention.

The Cumberland and Westmorland Farm School, Newton Rigg, Penrith, combined with Armstrong College to exhibit examples

of dairy work and matters of general interest in connection with dairying and horticulture.

Other bays contained specimens of crops showing the effect of various plant diseases. The College, in conjunction with the Royal Agricultural Society, provided an exhibit of photographs, prints and paintings showing the development of the various breeds of Northumbrian sheep from about 1780 till the present time. The breeds included the Blackfaced, the Cheviot, the Border Leicester and the various cross-bred sheep in the north. These two bays were in charge of Professor Gilchrist and Alderman Parlour of Darlington.

In a part of the show-ground adjoining the cattle sheds were given a series of clean milk demonstrations of considerable educational value, from the cleaning of an actual cow's udder to the final distribution of the milk.

A word in conclusion might usefully record that the Ministry's own exhibit proved far from unattractive to a large number of visitors. It dealt with clean milk production, silos, model cottages, model cow-houses, etc., seed-testing, harmful weeds, potatoes immune from wart disease, bee-keeping, rat destruction, manuring of grass land at Rothamsted, and pests of farm and garden crops. In addition its publications stand for the sale of this *Journal*, leaflets, and other publications, was kept very busy.

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IN the issue of this *Journal* for December, 1921, p. 769, reference was made to the results of an investigation carried

### **Inheritance of Milk Yield.**

out at the Maine Agricultural Station with the object of ascertaining the influence of the dairy bull on the milk yield of his daughters. It was shown that, when an analysis was made of the "Advanced Register of Dairy Bulls" maintained by the Jersey Breed Association, the fact emerged that, out of 200 bulls the records of whose daughters were available, approximately one half sired daughters whose records surpassed those of their dams.

The results of a similar investigation in relation to the Holstein-Friesian breed have now been published,\* and are worthy of mention, agreeing as they do with the results obtained in regard to the Jerseys. An examination of the Advanced Register of this breed showed that there were 111 Holstein-Friesian sires having two or more daughters with recorded yields. Of these, 65—or roughly one-half—raised the milk

\* Maine Agricultural Experimental Station, 37th Ann. Rept., Orono, Maine, 1921, pp. 251 *seq.*



yield of their daughters over that of the dams of these daughters. The list was headed by a bull which on an average raised the milk yield of his daughters by 7,640 lb.; another raised the milk yield of 14 daughters on the average by 4,860 lb.

These figures are independent of any theory: they show clearly how important an influence the sire exercises on the performance of his daughters. They demonstrate, moreover, that pedigree by itself is not a guarantee of performance: pedigree makes performance more likely, and it appears to be an even chance whether a pedigree sire will raise the level of the herd or not. Although the probability that he will maintain it at the same level is greater, still the fact remains that he sometimes lowers it and that the best test of the milking quality of a sire is provided by the records of his progeny. It is, therefore, to be deplored that, for reasons which appear to be peculiar to this country, the prevalent practice is to slaughter the dairy bull before the records of his daughters are available. (A reference to the Swedish practice of keeping bulls until the performance of their progeny is available, is made by Sir Daniel Hall at p. 397.)

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DURING the past nine months, the Ministry has received numerous requests for information on the growing of medicinal

**The Growing of  
Medicinal Herbs.**

plants; and, in consequence, it was considered desirable to make inquiries, in conjunction with the Ministry of Health,

to ascertain if there had been any material alteration in the position of this industry since the previous inquiry in 1916. Following a Conference with the National Health Insurance Commission (England) in that year the Ministry of Agriculture came to the conclusion, reported in the issue of this *Journal* for February, 1917, that there was not sufficient scope in the total quantities required of medicinal plants to justify it in making recommendations which might tend to encourage, or even mislead, a certain class of person into taking up the cultivation of medicinal herbs as a source of livelihood. Leaflet No. 288, which had been issued since 1914, giving particulars of some of the various medicinal plants, was accordingly withdrawn, it being felt that the circulation of such a leaflet would imply that herb growing could be regarded as a remunerative commercial possibility.

The result of the present inquiry shows that the position remains unchanged. It appears that there are abundant sup-

plies of medicinal herbs available at the present time, and that there are no grounds for apprehending any shortage in the future. The supplies are chiefly derived from overseas, and the prices approximate, generally, to those obtaining before the War. In view of the large quantities of low-priced herbs obtainable from abroad, it seems unlikely that the extended production of medicinal herbs in this country would be successful as a commercial undertaking, except, perhaps, on the part of those who have exceptional opportunities for disposing of their products, such as wholesale druggists growing their own herbs; or of those whose production of herbs forms but a small part of their total output of horticultural produce, and who can increase or reduce the areas they devote to herb growing in accordance with market requirements. While some of the medicinal herbs grown in this country are believed to be of superior medicinal quality to those obtained from abroad, the difficulties and expense of collecting small quantities grown in scattered situations, and of properly drying them, would appear to preclude individual small growers from selling their herbs profitably in a limited market already well supplied with foreign produce dried under more favourable climatic conditions.

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A PAPER containing proposals for increasing the average yield of farm crops by a system of farm competitions was read before

**Prizes for  
Well-Cultivated  
Farms.**

the International Congress of Agriculture which was held in Paris in May, 1923. The author, Monsieur H. Miserez, of the Belgian Ministry of Agriculture, pointed out that the means by which the present day yield can be increased are already well known and are practised by a number of cultivators. Heavier and more intelligent manuring, the improvement of the physical condition of the soil by suitable cultivation, the use of improved seed, prevention of plant diseases, etc., have produced a steady rise in the average yield of crops during the last forty years. In order to push production to the maximum possible a wide propaganda is necessary, in order to ensure the adoption of the improved methods by all cultivators. For this purpose competitions for farm crops should have as great an influence as has been exerted on animal breeding by live stock shows or competitions. The author suggests that such competitions should be organised on a large scale by local agricultural authorities and by agricultural associations, with the collaboration of agricultural colleges, etc.,



and the assistance of the State. The manner in which they should be organised and the form of assistance by the State or by local authorities would naturally depend upon the conditions of different countries, but some principles of general application are laid down, viz., comparatively large prizes should be offered, which would be open to all farmers in the district cultivating more than a prescribed acreage. A Committee of Judges would visit each farm, to award the prizes and also to give the competitors advice and instruction on the spot. Great publicity should be given to the awards, and the finest crops should be reserved for distribution in the district as seed. The popularisation by this means of improved varieties and strains is regarded by the author as one of the most important results to be aimed at.

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THE Minister has appointed a small Departmental Committee to inquire into the operations of the Fertilisers and Feeding Stuffs Act, 1906, to advise whether any, and if so what, amendments are necessary in order to render the execution of the Act more economical and effective, and to report accordingly.

**Fertilisers and  
Feeding Stuffs  
Act Committee.**

The Committee consists of the following:—

Lord Clinton (Chairman).	Mr. Brian S. Miller.
Mr. E. Richards Bolton, F.I.C., F.C.S.	Mr. George Stubbs, C.B.E., F.I.C.
Mr. E. G. Haygarth Brown.	Dr. J. F. Tocher, D.Sc., F.I.C.
Dr. Charles Crowther, M.A., Ph.D.	Dr. J. A. Voelcker, M.A., Ph.D.,
Mr. Thomas Kyle.	F.I.C.

Mr. H. J. Johns, of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W., has been appointed Secretary to the Committee.

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ALL growers of potatoes who may desire to sell any of the crop for planting should bear in mind that the Wart Disease of Potatoes Order of 1923 requires all potatoes sold for planting to be officially certified.

**Inspection of  
Potatoes for  
Planting.**

The certificates are of three kinds: (1) that the potatoes have been grown on land believed by the Ministry of Agriculture to be free from Wart Disease; (2) that the crop has been inspected and that on such inspection Wart Disease was not found to exist; and (3) that the potatoes were

inspected whilst growing and were found to be of an approved immune variety, true to type and reasonably free from "rogues."

Certificate (1) can be issued direct from the Ministry in respect of the land in the greater part of England outside the main infected area. In the case of land which is near a known case of Wart Disease inspection of the crop may be necessary, and certificate (2) will be issued if this inspection is satisfactory. Growers of immune varieties should arrange to have their crops inspected so that a certificate (3) may be issued.

Only potatoes with this latter certificate are allowed to be planted in land infected with Wart Disease, and, moreover, it is in the interests of growers generally that the stocks of the immune varieties should be pure and free from "rogues."

The inspection for purity must be made while the crop is still growing, and applications for inspection should be sent to the Ministry as soon as possible, as after the crop has died down the necessary inspection cannot be made.

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Owing mainly to the reductions in the prices of fat sheep and milk, the general index number of the prices of agricultural produce has declined from 54 per cent.

**The Agricultural  
Index Number.**

above pre-war in May to 51 per cent. above in June. The fall would have been more noticeable but for the fact that British fruit, which was selling at nearly double the pre-war price in June, is now included in the general figure, after being off the market since early in the year. During the last five months prices of agricultural produce generally have been about 10 per cent. below those of the corresponding month of last year.

The following table shows the percentage increase in each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING  
MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ... ..	200	183	75	68
February ... ..	195	167	79	63
March ... ..	189	150	77	59
April ... ..	202	149	70	54
May ... ..	180	119	71	54
June ... ..	175	112	68	51
July ... ..	186	112	72	—
August ... ..	193	131	67	—
September ... ..	202	116	57	—
October ... ..	194	86	59	—
November ... ..	193	79	62	—
December ... ..	184	76	59	—



Wheat and oats realised 1d. per cwt. more than in May, but barley was 3d. per cwt. cheaper. Oats usually appreciate in price during June, and barley prices usually decline whilst wheat remains stationary, so that the index figure of oats was reduced by 1 point whilst those of barley and wheat each advanced by 1 point. Potatoes rose very slightly during June, when there was a rather better demand at some markets for King Edwards, but the rise was relatively less than before the war and the index number declined to 31 per cent. below the pre-war price. Hay was 42 per cent. dearer than in June, 1911-13, and the decline in prices throughout the present year having been normal, the index figure has remained about the same since January.

The average price of fat sheep was 2d. per lb. lower than in May, and 83 per cent. above the pre-war price, a decline of 20 points on the month. Fat sheep are therefore relatively cheaper than in any month since January last and 17 per cent. below June, 1922. The reduction of 2d. per stone in the price of fat cattle as compared with May was relatively much the same as in pre-war years, but the fall of 5d. per stone in the case of fat pigs was relatively greater than before the war. Fat pigs were 69 per cent. dearer than in June, 1911-13, against 72 per cent. dearer in May, whilst fat cattle only declined by 1 point from 53 per cent. to 52 per cent. above pre-war.

Dairy cows were about 10s. per head cheaper than in May, but remained at 50 per cent. above the pre-war price. Store cattle were also cheaper than in May, but store sheep and pigs, though declining in price, were relatively dearer than in the previous month, the fall in June being relatively less than in 1911-13. Whilst store cattle were cheaper than in June, 1922, store sheep and pigs were appreciably dearer than a year earlier.

With the low price of 7 $\frac{3}{4}$ d. per gallon payable for milk sent by producers in excess of their basic quantities, very little surplus milk has been forwarded, so that the average price of milk sold under contract in the London and Birmingham areas shows no change from last month, but owing to a much larger proportion of the milk sent to the Manchester district being sold at 10d. per gallon, the average over all has declined from 63 to 53 per cent. above pre-war; even so, contract milk generally is about 20 per cent. dearer than in June last year. Butter declined by 1 $\frac{1}{2}$ d. per lb. and was only one-third above

the pre-war price, but the decline in cheese was relatively less than in 1911-13, so that the index figure is 2 points higher than last month. Eggs were dearer, but were only 40 per cent. above 1911-13 against 69 per cent. in June of last year.

The following table shows the average increases during recent months in the prices of the principal commodities :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN  
THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922.						1923.					
	June	Feb.	Mar.	Apr.	May	June	June	Feb.	Mar.	Apr.	May	June
Wheat ...	60	28	27	31	37	38	60	28	27	31	37	38
Barley ...	58	12	8	11	16	17	58	12	8	11	16	17
Oats ...	57	39	36	39	42	41	57	39	36	39	42	41
Fat cattle ...	71	61	54	51	53	52	71	61	54	51	53	52
Fat sheep ...	121	97	94	100	103	83	121	97	94	100	103	83
Fat pigs ..	82	88	77	71	72	69	82	88	77	71	72	69
Dairy cows ....	64	67	58	55	50	50	64	67	58	55	50	50
Store cattle ...	40	36	31	29	33	31	40	36	31	29	33	31
Store sheep ...	88	100	92	92	98	114	88	100	92	92	98	114
Store pigs ...	97	154	136	131	126	130	97	154	136	131	126	130
Eggs...	69	46	55	37	43	40	69	46	55	37	43	40
Poultry ...	116	80	81	75	77	87	116	80	81	75	77	87
Milk ...	28	90	87	70	63	53	28	90	87	70	63	53
Butter ...	59	72	70	68	40	33	59	72	70	68	40	33
Cheese ...	55	88	95	92	42	44	55	88	95	92	42	44
Potatoes ...	80	—5*	—12*	—28*	—28*	—31*	80	—5*	—12*	—28*	—28*	—31*
Hay ...	35	42	42	40	41	42	35	42	42	40	41	42

\* Decrease.

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THE Minister of Agriculture has presented to the House of Commons a Bill to facilitate the confirmation of wages agreements reached by Conciliation Committees.

### Conciliation Committees in Agriculture.

The Bill provides that the Minister's powers under the Corn Production Acts (Repeal) Act, 1921, to confirm a rate of wages agreed upon by a Conciliation Committee may, in the case of an agreement made after the passing of the Bill, be exercised on application in writing by a majority of either side of a Committee (instead of as at present only on application by a Committee as a whole).

Section 2 of the Bill provides that a Committee's power to issue a certificate that a contract for the payment of wages to any particular worker at a lower rate than the rate agreed by the Committee is fair and reasonable having regard to the special terms of the contract, shall be extended to enable the Committee to grant such a certificate in respect of all workmen employed on the same special terms in the area.

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## AGRICULTURE IN SCANIA.

SIR DANIEL HALL, K.C.B., LL.D., F.R.S.,

*Chief Scientific Adviser and Director-General of Intelligence  
Department, Ministry of Agriculture and Fisheries.*

IN June of the current year, Mr. M. W. F. de Wachenfelt, Agricultural Adviser to the Swedish Legation, organised a tour of British agriculturists in southern Sweden and invited the participation of representatives of the leading agricultural organisations in England and Scotland. A party of 15 left London on June 11th and were joined later by Sir Douglas Newton and Mr. German of the National Farmers' Union.

The party travelled by way of Esbjerg and spent their first day in Copenhagen, where they visited the Royal Veterinary and Agricultural School and the Seed Testing Station. The reputation of the College, which was founded as long ago as 1858, is world wide; one was impressed by the completeness of the equipment and the evidence of continued extension, still in progress. The College is situated in Copenhagen itself, and the course of instruction embraces nothing of what would be called in this country "practical work" upon a farm, but the students, of whom there are now over 500, are not admitted unless, in addition to a satisfactory general education, they have had three years' previous experience upon a farm. Thus a high standard of instruction both in agriculture and in the sciences bearing upon it can be maintained. Both here and at Alnarp, the Swedish college that the party visited later, the most notable comparison with British colleges lay in the completeness of the technical equipment for dealing with subjects like agricultural machinery and the industries connected with agriculture, such as dairying and distilling; there was every provision for the fundamental preliminary training of factory managers. The party was entertained to lunch by Dr. Ellinger, the Director, and his staff, and then went on to the Seed Testing Station, where it was received by the Director, Dr. Dorph Petersen.

Copenhagen possesses the oldest seed testing station in the world, and its methods have become classical. Perhaps the most interesting feature is that seed control in Denmark is not enforced by law but is a voluntary control into which all the great seed firms of the country enter. Briefly put, the guarantee given by the seed merchant covers the strain of

seed as well as its purity and germination, and the control takes its own measures to check the guarantees, not necessarily at the instance of the purchaser. The control also regulates the procedure to be followed when a sample proves deficient and compensation has to be paid to the purchaser. To those who know Dr. Dorph Petersen it is unnecessary to insist on the impression he made by his enthusiasm and his kindness.

**Farming in Scania.**—From Copenhagen the party crossed to Malmö, which became its headquarters during the next three days spent in excursions in Scania, the southern and most highly cultivated province of Sweden.

The country is low, gently undulating, covered with a soil of glacial origin and generally of a light freely-working nature. No hedges are to be seen, woodlands only upon the hills, and the whole country is under the plough. Save for some marshes by the sea the only permanent grass that was seen was one great area of meadow occupying the bed of a reclaimed lake. Except for an occasional boggy patch and pond in an undrainable depression, such as are characteristic of glaciated areas, there was no waste land; cultivation came right up to the roadsides. The other characteristic of the landscape was the high-tension cables that traversed the land, with the occasional towers containing transformers, carrying current to all the farms for light and power purposes from the great water power station at Trolhatten some 400 miles away. The main crops were wheat, barley, oats and rye, the latter to almost as great an extent as the other cereals; sugar beet, with other root crops less prominent; red clover and a grass mixture in which cocksfoot showed up strongly; also a certain proportion of a mixture of peas and barley for fodder purposes. As in all north-west Europe the crops were in need of warmth and sunshine.

The most striking feature was the general uniformity of the farming; not only were all the farmers growing the same crops in the same way, but a high level of cultivation was very evenly maintained. Some districts were better than others as the soil varied, but one did not pass suddenly from a good to a bad farm as is so often the case in England. Very few stock were to be seen in the open: some of the farmers had begun to graze their leys, the milch cows being tethered in a long line so as to advance uniformly over the field, but in a large number of cases the cattle remain indoors throughout the whole year. This naturally involves extensive buildings.



which in the majority of cases were modern, airy, well-lighted structures with the standings for the cows, the bull pens and calf pens under the same roof. All the crops are brought under cover, the barns on the large farms being of vast dimensions. The system of farming is founded upon corn-growing and dairying on the soiling plan, with pigs as the secondary live stock, though not in all cases. Sheep were but little seen. Sugar beet was important within the zones of the sugar factories; in a few instances it was used for distilling. The cattle in Scania were nearly all Swedish Friesians, perhaps a little smaller but not differing essentially in type from the Friesian as we know it. For many years milk recording has been general and breeding and selection have been founded upon the records with the result that a very high average level of performance has been attained, this being regarded as of more importance than record performances of individual cows. But the sort of average results obtained may be judged from the following results in 1921-22. The Alnarp College herd, 153 cows in milk, average yield 9,020 lb., with 3.2 per cent. of butter fat; Baron Ramel's herd, 104 cows in milk, average yield 9,160 lb., 3.25 per cent. butter fat; Mr. Stjernswärd's herd, 91 cows in milk, average yield 10,060 lb., 3.56 per cent. butter fat; Baron Blixen Finecke's herd, 135 cows in milk, average yield 10,250 lb., 3.4 per cent. butter fat; and the Bondesson herd of about 50 cows in milk, average yield 10,800 lb., 3.5 per cent. butter fat. Some of the smaller herds gave remarkable results; for example, a herd of 14 cows only, which in 1921-22 gave an average yield of 17,540 lb. with 3.57 per cent. of butter fat. The other breed prevailing in this part of Sweden, though as a rule associated with the poorer land, was the Swedish Ayrshire, which from an original Scotch stock has been developed to a larger size, coloured almost all over. Again it is being bred mainly upon lines dictated by milk records.

One striking feature was the docility of the bulls; we saw bulls still in use up to 11 years old, a practice which is very helpful in breeding for milk, for the bull is still available when the performance of his progeny can be seen. Again at the Gothenburg show there were classes for groups of cows and a bull, all tied up in a row without partitions.

In connection with cattle breeding, perhaps the most interesting sight was at Simlinge, the centre of a Bull Society founded in 1902. The small farmers who constitute the

society own two bulls, and the members had assembled by the roadside for the party's inspection a selection from their respective herds—the two bulls, and some younger bulls going to the annual sale of pedigree stock at Malmö, cows in milk and heifers, the progeny of the Society's bulls. The cows, all registered, were perhaps a little smaller and shorter in the leg than the show specimens of the breed, but were typical farmers' cows with a very high level of performance. It was a member of this society whose herd gave the remarkable results recorded above.

Many of the larger herds were tubercule free, and very special precautions were taken to avoid infection, some of the owners, for example, would not keep pigs on the same farm.

Pigs were of the large or middle white class, pure bred or crosses of the native breed with large white boars. The bacon factories, of which we saw an example at Trelleborg, insist upon a uniform type for the export market, and this factory issued a monthly leaflet dealing with points of feeding and breeding.

An interesting feature of the farming of Scania is that the system of tenure is not unlike our own. It is not a country of small holdings, and though in some districts small occupier-owner farms predominated, more generally it is a country of large estates, divided into rented farms of varying size, even up to 1,000 acres, held as a rule on lease. The landowners take a leading position in the farming of their estates and in the organisation of co-operative societies, bacon factories and the like. The home farm is generally of considerable size and is farmed on strictly business lines.

Rents, we were told, are about 30s. an acre; wages are about the same as in the north of England and Scotland, equivalent to 36s.-40s. a week but longer hours are worked than in England. On some of the estates there are cottages with about 5 acres of land, the occupiers of which put in two or three days a week as labourers upon the estate. The world's break in prices had caused great farming losses in Sweden as elsewhere, the worst of the depression having been experienced last year. We were told of the perilous position of many men who had bought and stocked farms in the period of exaggerated prosperity towards the close of the war; nor were the sellers much better off for the high prices they had received, because they had invested their money in industrial securities which



had dropped enormously in value and were yielding no income. The sound men were those who had held on their way during the war, neither buying nor selling.

With this brief account of the general impression made by the farming of Scania we may now turn to some points of more specific interest.

**The Malmö Agricultural Society.**—The Malmö Agricultural Society by which the party was received on its arrival, is typical of the organisations through which much of the work of agricultural improvement is carried on in Sweden. It is a private corporation but the greater part of its income is derived from the State, the Society being the agency employed for the provision of advice to farmers and the organisation of societies for such purposes as milk recording, improvement of live stock, improvement of seed, etc. State loans for such purposes as the building of cottages pass through the hands of the societies, which indeed in a large number of cases fulfil the function, vis-a-vis agriculture, of the Local Authorities in Great Britain. The Society possesses in Malmö a large building with a meeting hall, library, offices and laboratories. The Society owns the adjoining Market Hall where the regular weekly sales of the live stock of the district are held as well as the annual sales of pedigree stock from the milk recording and breeding societies. The Society derives a considerable annual income from its market. The Society's buildings contain veterinary laboratories, the officers of which are partly employed in the control connected with the market, and partly in investigation and the preparation of serums for use in dealing with the various cattle diseases that cause trouble in the district. Here, too, are housed the offices, store rooms, etc., of the Scanian Butter Export Society. All butter passed for export is examined here for packing and weight, the control as regards quality, water content, etc., being exercised by surprise inspections and analyses of the products of the dairies within the control, who alone have the right of putting the State brand upon their produce. The Society employs a staff of advisers who deal with the farmers either as regards general advice on their farming or such specific matters as the control of the herd books and milk records. This method of conducting so much of the work of education and agricultural improvement through the Agricultural Societies is justified as keeping such matters out of the sphere of politics, either local or national, and in the hands of the farmers themselves.

**Alnarp Agricultural College.**—At Alnarp the party visited the great Agricultural College, one of two in Sweden. It is an extensive institution founded about sixty years ago and includes the Agricultural College proper, the Horticultural College, the Agricultural School, a Dairy School and a School for instruction in Horse Shoeing. The College gives a two-year course of higher instruction of a theoretical character for the training of the larger farmers and estate managers, officials ("agronomes"), etc., and entry is limited to those possessing a sound general education. In the School the course of instruction is shorter and includes practical work for the training of bailiffs and small occupiers. The institution possesses a farm of about 1,200 acres with a herd of some 300 Swedish Friesians, a thoroughly well-managed farm typical of the agriculture of the district, large enough not to have its economy disturbed by subservience to the educational requirements of the College and School. The Dairy School is also engaged in the testing of all forms of dairy machinery and appliances, thus ensuring that the factory manager in course of training becomes acquainted with the most recent forms of machinery.

**Winter Schools of Agriculture.**—In connection with education we may also mention the Winter Schools of Agriculture of which we saw an example at Hvilan, near Alnarp and another at Fridhem, by Svalöf. To quote from the very excellent descriptive itinerary prepared for the party, "In Scania it is customary for the sons of average farmers, a few years after leaving the primary school to pass through a course at the High School at which instruction is given in general education; and afterwards a course at an Agricultural School, where special agricultural knowledge is acquired. Each course embraces one winter." The school at Svalöf was a handsome building rebuilt in 1920 and it is noteworthy that the whole of the funds required for its erection were obtained by private subscription from the farmers in the district, since the State assistance does not extend to capital but only to maintenance. The building contained classrooms, library, and laboratories on the ground floor, with the hostel above, each student having a room to himself.

**Institute for Research in Breeding.**—Adjoining the Alnarp Estate is the Institute for Research in Breeding belonging to the University of Lund. Here the party was received by Dr. Nilsson Ehle, so well known for his investigations in the breeding of wheat, of which "Swedish Iron" is an out-



come now well known in England. Dr. Nilsson Ehle gave the party an address on the objects and methods of plant breeding, with special reference to wheat, which was a model of clear exposition, especially considering that he was speaking in an unfamiliar language. This served to elucidate much of the work that was seen both there and later at Svalöf.

**The Plant Breeding Station, Svalöf.**—Svalöf is probably the feature of Swedish agriculture best known to the world at large; in Great Britain two at least of its products—the “Victory” oat and “Iron” wheat—have spread its fame widely. The Swedish Seed Association began its work on the improvement of farm crops at Svalöf in 1886. Dr. Hjalman Nilsson became Director in 1890 and still holds office. It began with attempts to select the existing varieties of wheat, oats, etc., so as to obtain uniformity and increased yield, by the methods of what we now call “mass selection,” such as picking out the largest ears to be found in a field or the best plants in other respects. Thereby little success was obtained beyond a relative uniformity and purity of type. Any old-established variety, say of wheat, even if pure, and commercial varieties even down to recent years were rarely anything like pure, consisting of a mixture of slightly differing strains, all of the same general type but varying in such features as the number of grains the ear will produce, the height and strength of the straw, etc., etc. If one picks out all the long ears some will owe their length to the accident of having obtained a little extra nutriment or water, others—and this will be the smaller number—to some essential quality in their make up which is passed on to the seed arising from them. But in the mixed batch of seed arising from the selection of the long ears, grains will predominate that were derived from ears owing their length to the accident of nutrition and these will not pass on the long-eared character. Consequently the result on sowing will be the reproduction of the original mixed population with relatively few of the true long-eared types, and the improvement of the variety seems as far off as ever.

However, there are real long-eared strains in the mixed population and these can be isolated if instead of sowing the seed from all the long ears together they are grown on as individuals. Then the next year's growth reveals which of them owed their excellence to accident and which to hereditary make up. The best of the latter are saved, again tested as individuals, and eventually a selected one is propagated on a large scale. Thus is initiated a “pure line,” the produce of a single individual, which

continues to breed true and carries on the superiority which that individual showed to the bulk of the population from which it was derived. This "pure line" mode of selection was introduced at Svalöf about 1893, and it did result in considerable improvement—complete uniformity of crop and increases in the productivity of the order of 5-10 per cent. above that of the old mixed variety. Still it led to nothing new, for new varieties only arise through cross-breeding.

Cross-breeding, however, seemed to result in nothing but confusion and it was not until about 1900 when the bearing of Mendel's discoveries became generally apparent, that plant breeders were put in possession of a method of picking out the fixed races among the innumerable varieties that arise in two or three generations from a hybrid. Now the technique is established in dealing with self-fertilised plants like the cereals; we know that after the cross the characteristics of the two parents will not be merged but reassorted in every possible combination in the progeny of the second and third generation and that some of these combinations will be "fixed" and incapable of further variation. The desirable ones can be picked out and the "fixed" forms isolated, by the method of pure line breeding from individuals. Thus the production of "new" varieties combining the good points of various individuals has been reduced to a system, and this is the method now followed at Svalöf as at other plant breeding institutions.

The plant breeding institution at Svalöf began as a farmers' association and still derives part of its income from subscriptions. Of its present total income of about £20,000, about £11,800 comes from the State and about £5,000 from the Seed Company which sells the new varieties. The Seed Association possesses the buildings required for its work and about 40 acres for its trial plots, together with 8 subsidiary trial stations in other parts of the country. When it has raised a new variety and tested it sufficiently on its small scale, it hands it over to the Swedish Seed Company, the quantity being then perhaps a couple of hundredweight.

The Swedish Seed Company is a separate organisation, with a capital of over a quarter of a million sterling, which carries on the business of propagating and dealing in the products of the Seed Association. Its divisible profits are limited, the surplus being handed over to the Seed Association for the extension of the investigation and breeding work. It possesses farms of about 2,500 acres adjoining the plant breeding station at



Svalöf, and on these farms, as on the subsidiary stations in other parts of the country, the trials of any new variety are conducted after it has been handed over by the Seed Association. The Seed Association still, however, retains control, and the new variety may not be issued for sale until from the trials on a large scale the Seed Association is satisfied of its value.

The effects of the Svalöf organisation upon the character and quality of the crops grown in Sweden can hardly be exaggerated. It has not displaced the private venture seed firm—indeed, at Messrs. Weibuhll's, near Helsingborg, our party visited a commercial firm employing all the most scientific methods for the production of new varieties of farm crops—but it has set a standard throughout the country, and no farmer purchases a new variety unless its performance can be substantiated by the results of rigorous preliminary trials.

**The Bondesson Agricultural Company, Svalöf.**—It would be tedious to describe the many farms visited, but it is difficult to pass over the Bondesson Agricultural Company at Svalöf. This is a family company farming a little over 900 acres, but owning also a large butter and cheese factory, which handles about 1,700,000 gallons of milk each year. The separated milk and whey are utilised by a famous herd of large white pigs, the foundation stock of which were obtained in England—whence also regular purchases of boars are still made. The herd is maintained in a vast building alongside the dairy. There were at the time 60 breeding sows, and the progeny, so far as they are not sold for breeding purposes, were being fed for bacon. Altogether there were about 1,500 pigs in this range of buildings and the output of bacon pig amounted to about 6 tons per week.

In another building alongside was the dairy herd of about 115 animals in all, 50 cows in milk. It was pure-bred Swedish Friesian and had a high reputation in the show and saleyards. The average milk production was 1,080 gallons, with 3.5 per cent. of butter fat. This of course was a large capitalist undertaking.

**A Successful 150-Acre Farm.**—Perhaps a more normal farm equally good in its way was that of Mr. Nils Andersson, a member of the Simlinge Bull Society of which mention has been made above. Altogether Mr. Andersson farms about 150 acres of which he owns 130, and on this area he maintains a herd of Swedish Friesians numbering about 70 in all; he also

breeds horses and makes a speciality of seed cultivation. This is a notable example of intensive farming.

**The National Agricultural Show and the Jubilee Exhibition.**—The itinerary concluded with a visit to the National Agricultural Show, which was being held this year—after a long interval caused by the War—at Gothenburg, where also the great Jubilee Exhibition was in progress. Naturally the live stock was of most interest to the British party, which had an opportunity of seeing several breeds of cattle of wide distribution in Sweden but not generally kept in Scania. Among these the most notable was the polled race of white cattle with a few black spots, which is the most numerous race throughout the middle and northern parts of Sweden. It is a neat compact animal, bred and selected for its milk-yielding powers in a rough climate and on poor soils.

The Swedes are great horsemen, and horses figured prominently in the show. Blood horses and hunter type horses were very well exhibited, many examples coming from the State stud farms formed to promote the breeding of remounts. The most characteristic utility horse belonged to the Belgian Ardenne breed, largely used for the improvement of the country race, but very striking were the examples of small active Swedish breed with which two batteries of artillery were horsed.

It needs a better live stock man than the writer to discuss the exhibits, but two points seem noteworthy. There were several classes for bulls exhibited with their progeny. Again, judging was carried on by the score card system, and the cards with all the marks were posted up on the pen of each exhibit. Whatever the merits or demerits of judging by the score card one cannot deny the educational value of the posting up of the score card against each exhibit; the judges' opinions were there set out in detail for all to check and many were the discussions we saw in progress.

Finally, one cannot close without recording the extraordinary kindness and hospitality with which the British party was received. We were entertained by the owners of the great estates we visited day by day, by the Board of the Jubilee Exhibition and by the Board of the Agricultural Show at the dinner they gave in honour of the King. This, however, was little in comparison with the warmth of the welcome we received and the manifest desire of our hosts to make the visit both fruitful and pleasant to us.



## RED POLL CATTLE.

R. HARVEY MASON.

IN the Eastern Counties and probably elsewhere there are many poll cattle highly esteemed for grazing and some for milk among the tenant farmers. Many are red, but many more are variable in colour, looking chiefly like shorthorns without horns, though some probably have slugs and may have been with shorthorn or half red bulls.

It was out of this stock that pedigree Red Polls were selected many years ago. The blood-red colour was held in the highest favour, and many farmers in Suffolk and Norfolk were found early in the last century to have herds entirely red and to have been careful to breed from red bulls.

It was Mr. Henry F. Euren, the editor of the *Norfolk Mercury*, who in 1874 with the help of friends who were breeders of Red Polls in Norfolk and Suffolk and were keen about them, published the first volume of the herd book and registered as many Red Polls as he and his friends found up to a standard description. He did this until the Red Poll Society was formed. There were 44 breeders in Norfolk and Suffolk at that time who subscribed to this work, and among them was an ardent American, Mr. G. F. Tabor, of Ravenwood Farm, Patterson County, New York, U.S.A., who afterwards imported a good many of these cattle.

Mr. Euren called the cattle Red Polled, but this name was altered in 1909 by the Red Poll Society which did not admit that any herd ever had horns which had been polled. That society was established in 1888 and purchased the copyright of the books previously published from Mr. Euren.

There is no record of any Red Polls kept in any other counties in Great Britain at the time when pedigrees began, but Mr. Euren discovered that there was an old breed of these cattle in a remote part of Austria and that Prince Terchenstein in 1869 purchased animals from Lord Sondes, who then had a herd at Elmham in Norfolk, to infuse fresh blood into his herd of native bred cattle.

In Arthur Young's survey of Suffolk we find that Red Polls existed there in 1792, and previously to that in "The Suffolk Traveller," John Kirby of Wickham Market refers to the butter they produced being the pleasantest and best in England. Arthur Young found the cattle were spread over the whole county and were sometimes crossed with shorthorns, but he does not recommend this with a view to the dairy. In those days very

little if any attempt was made to improve the breed, until the agricultural societies were established and premiums were offered for Suffolk cattle pure bred, *i.e.*, by a Suffolk bull out of a Suffolk polled cow. Whether this plan should be established was discussed at a meeting at which the Earl of Stradbroke presided. It was pointed out that Norfolk also bred Norfolk cows generally called "home breds" and that pure red was its distinctive colour. Although there were polled cattle of various colours both in Norfolk and Suffolk, the Red was always held in best estimation as long ago as 1782. Mr. Marshall, agent of Lord Suffield, Gunton Estate, in the "Rural Survey of Norfolk" says:—

"The native cattle of Norfolk are a small, hardy, thriving race; fattening as freely, and finishing as highly, at three years old, as cattle in general do at four or five. . . . the head, in general, fine, . . . the favourite colour, a blood red, with a white or a mottled face . . . These two qualifications; namely, the superior quality of their flesh and their fattening freely at an early age . . . The medium weight of a well-fatted three-year-old is forty stone (of fourteen pounds each).

Bulls of the Suffolk polled breed have, . . . been brought into this District: and there are several instances of the Norfolk breed being crossed with these bulls. The consequence is, an increase of size, and an improvement of form: but it is much to be feared, that the native hardiness of the Norfolk breed, and their quality of fattening quickly, at an early age, are injured by this innovation . . .

The fact appears evidently to be, that the Norfolk husbandmen are in possession of a breed of cattle, admirably adapted to their soil, climature, and system of management: and let them cross with caution;"

The principal breeders in the early part of last century were in Norfolk: Mr. Reeve, of Wighton, Mr. England, of Binham, and Mr. George, of Eaton. These men co-operated to improve the native polled cattle by careful selection, and some of their stock were shown at the Holkham sheep shearing, and attracted much attention. At Mr. Reeve's sale in 1828 the advertisement reads "Eleven matchless blood-red cows in calf, two three-year-old heifers in calf, eleven two-year-old heifers in calf, and a two-year-old blood-red bull, one of the most perfect animals in the Kingdom." Mr. George is said to have bought a cow costing 25 guineas, which at the time was thought to be a very high price. His cattle were sold to go to several places both in Norfolk and Suffolk.

There is no doubt that the establishment of separate classes for Norfolk Poll Cattle at the agricultural shows in that county which were amalgamated into one in 1846, gave great impetus to the improvement of this stock.

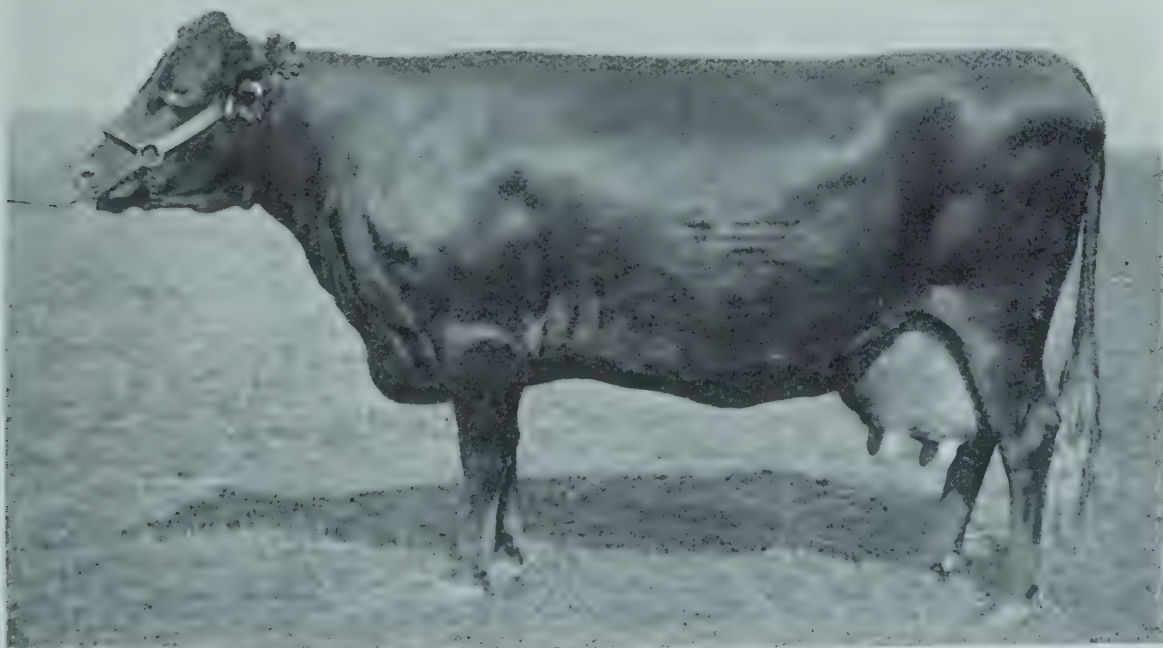




*Photo.]*

*[Sports and General.*

FIG. 1.—Red Poll Bull, Marham Florin : prize-winner at the Royal Show, 1923.



*Photo.]*

*[Red, Walslow.*

FIG. 2.—Red Poll Cow, 18051 Frill P3.



FIG. 3.—Group of Red Poll Cows, owned by Mr. R. Harvey Mason.



At the British Association Meeting at Norwich in 1868 Mr. Clare Sewell Read said:—

“We have to commemorate a grand revival of the Polled Norfolks as a numerous and distinct breed. The old fashioned gay home breeds are not recognised the true stamp of the improved Norfolks, for the latter are a blood-red and while slugs and horns are studiously avoided, and their milking properties well cared for, they possess a uniformity of character, style and make that would do credit to many of our established breeds.”

Red Polls are recognised to be a smaller breed than Short-horns, Friesians, South Devons or Herefords. An average cow's height is 4 ft. 2 in. and girth 6 ft. 6 in. In a grazier's yard 5 can be kept for 4 of the other breeds, some say 4 for 3. They are docile and feed quietly, whereas horned cattle are sometimes troublesome. The beef is of the same value as that of the Aberdeen Angus and cost of feeding is proportionate to the number which can be kept, as quoted above.

A good many Red Polls were exported to the United States from 1882 to 1888 and an American Society was established there. Several of the members were impressed by the value to them of hornless cattle, as horned ones damage horses and other cattle at the drinking places, and as the poll type predominates in cross herds they found a good market for bulls to use for crossing purposes, as the horns disappear.

**Milk.**—The Red Poll is distinctly a dual purpose animal, producing the best beef and rich milk. The milk yield varies from 5,000 to 12,000 lb. in a year, and owing to milk recording, a good trade for high grade milkers (which at first did not exist), and the breeding from bulls bred from prize-winning cows at dairy shows, milk records are fast improving. The butter fat testings show 3.5 to 4.1 per cent. of butter fat, and even up to 5 per cent. in some cases.

Up to about 1890 the principal trade was for exhibition and export. Americans north and south wanted fine meat and extra good looks, and consequently breeding followed those lines, little attention being paid to milk. This began to alter soon after the Chicago exhibition in which there were prizes for good milkers, and some buyers came over to select a few specially good milking cows which were to give at least 4 per cent. of butter fat. These men showed the farmers how they should buy cows. They went to the early and late milkings and each time brought a Babcock Tester, and tested the milk. This was long before milk recording was carried on as it is now.

**Beef.**—Red Polls have been always noted for the prime quality of the beef they produce. Graziers have generally obtained 1s. or 2s. a stone more than butchers will give for larger breeds. At the present time there is considerable inquiry for small joints, and Red Poll steers sell well both as stores and finished meat. At a Smithfield Club show weights as follows were recorded :—

				weight		
	years	months	days	cwt.	qr.	lb.
Red Poll Steers under 3 years	1	4	4	11	3	27
	2	10	16	15	2	26
	2	10	18	16	2	23
Heifers under 3 years	2	10	14	15	3	9
Steer „ 2 „	1	10	3	11	3	27
	1	9	8	12		

**Description.**—The following is the standard description of the breed :—

*Characteristics and Form.*—

Colour :—Blood-red ; deep red for preference ; tip of tail and udder may be white.

Head :—Must be poll, *i.e.* not artificially polled and without horn, slugs or abortive horns.

Nose :—White.

Hips :—Evenly rounded ; not prominent.

In all other particulars the commonly accepted points of a superior animal to be taken as applying to Red Poll cattle.

*Objections.*—

Any extension of white in front of the udder.

Any white on a bull except on tip of tail.

A cloudy or dark nose.

*Disqualifications.*—

Any horns, slugs or abortive horns.

Any signs of artificial polling.

A black or blue nose.

Any white except on the tip of the tail, the udder, or for a short way under the body.

Any colour other than red.

In the first herd book the herds were divided geographically into groups and these groups were subdivided into tribes, certain cows being selected as foundresses of the tribe. This plan has been found very useful for breeders. This book contains only 38 breeders, all from Norfolk and Suffolk. Since that time the members of the society have increased gradually and it now includes 449 spread over a large part of England, Wales and Scotland, and a few in Ireland. Exports have recently gone to



France, Norway, Sweden, South Africa, Rhodesia, Argentina, Brazil, Uruguay, Australia and New Zealand.

The number of registered Red Poll cattle is 5,661, including bulls and cows. Many have passed into the hands of wealthy men. In fact, the value of the herd has been so high that only wealthy buyers have been able to obtain the best animals. Members of the society are still increasing and as there are herds that include very few cattle it may be expected that the future sales will be well attended.

**General.**—Cattle that have flourished on the poor pastures of East Anglia will go on to much better land, and it may be expected that owing to the careful selections that have been made, to the use of only the best bulls, and to the finer pastures on which they will feed, great improvements in the breed may be expected before long. The best way to improve is to scrap the worst and keep the very best cows and heifers to breed from. The shows and sales promoted by the society will enable breeders to do this. Formerly, until these sales were started, one might wait some time for customers to come along and then naturally they wanted the pick, and if such were continually sold, the herd would go back and require time to recuperate.

In Norfolk and part of Suffolk the pastures are not good as compared with the midlands and west of England. Moreover, the parks are usually well timbered and consequently flies are a great torment to cattle. The larger breeds have seldom obtained any great success in consequence of this in those counties, but Red Polls do quite well. Their habit in warm weather is to feed and also to stand in clumps together, and their tails whisk the flies off one another.

At the agricultural shows Red Polls are increasing in numbers, and their quality is distinctly better than ever. His Majesty the King is patron of the society and is a successful exhibitor, and one may hope that before long he may breed a champion bull and cow.

The colour of a herd of Red Polls is very attractive on the green background of a well wooded park, and if there is any drawback at all it may be that, when they are a well matched breed rather than a collection of various types, it is difficult to distinguish one cow from another except by the ear marks. After all, the herdsmen always know them well and can help the owner out of any mistakes. These men get very proud of the animals of which they have the care, become fairly good

judges of them, and can help in the selection of such as are worth exhibiting. They are generally capable of remembering something of the pedigrees and if there is a distinction between sires to use they do not and should not make any mistakes. A good milker can often advise about the udders of cows when there is a difference in the way they milk, and they take readily to the work of recording the weights of milk and entering them on the weekly sheet.

It is advisable to have all one's calves trained to be led and tied up, as it makes them more docile afterwards, and less inclined to get wild when turned out to grass, and finally as heifers come to be served or sent to sales and cows to be tied up for milking. Bulls of course require rather more training to lead than females. Comparatively few males are worth keeping for pure breeding in this country, but in America, Africa, Australia or other countries that have inferior native cattle almost all bulls can be sold at remunerative prices for cross breeding, with the result of immense improvement in the cross breed.

Milk recording has not been carried out long enough for generalisation on particular matters.

#### **Red Poll Cattle Societies in the Colonies and Abroad.—**

*Australia.*—President, the Hon. T. H. Payne, M.I.C., Wordburn, Kilmore, Victoria.

Vice-President, Colonel Arnold Caddy, Chandpara, Tylden R.S.O., Victoria.

*New Zealand.*—Norman Inder, Secretary, New Zealand Cattle Breeders' Association, Kotare, Matatera.

*South Africa.*—J. Fraser, Secretary, Box 250, Bloemfontein.

*Canada.*—P. J. Hoffman, Secretary, Aannaheim, Saskatchewan.

*United States America.*—W. A. Martin, Richland Center, Wisconsin, U.S.A.

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## **SHEEP SCAB: ITS PREVENTION AND REMEDY.**

REPRESENTATIONS have been made to the Ministry during the past year by agricultural bodies representative of a considerable body of opinion amongst sheep owners, in favour of more drastic measures with a view to the eradication of sheep scab. The position of the country with regard to sheep scab is not satisfactory. The number of outbreaks reported by Local Authorities during the past four years is as follows:—



<i>Year</i>		<i>England</i>		<i>Wales</i>		<i>Scotland</i>		<i>Total</i>
1919	...	245	...	69	...	124	...	438
1920	...	240	...	107	...	129	...	476
1921	...	368	...	206	...	183	...	757
1922	...	284	...	246	...	153	...	683
1923 (to 30th June)		158	...	139	...	47	...	344

It will be observed that although there has been a slight improvement since the close of the year 1921, the number of outbreaks still continues large, particularly in Wales and the Highlands of Scotland.

One of the principal difficulties in securing the eradication of scab is the general carelessness and apathy displayed by many sheep owners in carrying out the Sheep Scab Orders and dipping operations, and the reluctance which still apparently exists to accept double dipping (that is, two dippings in a sheep dip approved by the Ministry with an interval of not less than 7 and not more than 14 days between them) as the effective method of preventing and curing scab.

In view of the strong and growing feeling amongst agriculturists throughout the country in favour of a more determined attempt being made to eradicate this disease, the Ministry has, during the past few months, given publicity to a proposal to throw the onus of curing and preventing scab upon each owner of sheep, and has received expressions of opinion in favour of such a policy from many agricultural bodies and Local Authorities.

An Order has accordingly been made which will give effect to this proposal by directly requiring sheep owners to take such steps from time to time as are reasonably practicable to secure that their sheep are free from sheep scab. The Order further provides that occupiers of farms or holdings upon which sheep are kept, and owners of sheep kept on common land, shall be liable in case of failure to take such steps as above-mentioned, to the penalties prescribed by the Diseases of Animals Acts, viz., to a fine of £20, or if the offence is in respect of more than four sheep, to a fine of £5 for each animal, or in certain cases, to imprisonment. It is an important provision in the Order that in the case of proceedings instituted thereunder on or after 1st July, 1924, in any case where sheep scab is found, the burden of proving that the Order has been complied with will rest upon the person charged and not upon the prosecutor.

A pamphlet has been issued by the Ministry containing full information as to the measures which it is advisable to take in connection with sheep scab.\*

The effective method of curing or preventing sheep scab is double-dipping, that is dipping twice with an interval of not less than 7 and not more than 14 days between the two dipplings, provided that the dip used is one that has been approved by the Ministry, and care is taken to see that the dipping is thoroughly carried out in accordance with the instructions on the label. Unless the dipping is properly done scab can never be eradicated.

When dipping to comply with Orders of the Ministry or Regulations of the Local Authority, it is of the utmost importance to remember that:—

(1) The dip used must be one that has been approved by the Ministry. There are a large number of effective dips for scab, non-poisonous as well as poisonous, which have been so approved and the responsibility in selecting an approved dip rests with sheep owners;

(2) The dipping bath must be mixed in the proportions specified as approved by the Ministry. It is inadvisable to make up a dipping bath by mixing two or more dips together, as this may result in neutralising the effect of both dips for scab, and may in some cases be injurious to the sheep;

(3) The directions and precautions indicated by the manufacturer on the label must be strictly observed;

(4) The sheep must be kept immersed in the bath for the period mentioned on the label. Special attention should be paid to the heads, necks, and tails;

(5) During the dipping operations proportionate quantities of dip and water must be added to keep the bath up to the proper strength; it is best to mix these *before* they are added to the bath;

(6) After each lot of sheep has been dipped and before the bath is re-mixed the dipping bath should be carefully cleaned out, the residue being disposed of in such a manner that it cannot injure animals or pollute streams. A satisfactory method is to run the residue from the bath into a trench or pit, the sides and bottom of which have been plentifully sprinkled with lime, so that the liquid from the bath runs through the lime before passing into the soil. This is

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\* Copies of the pamphlet can be obtained free of charge from the police or from the offices of the Ministry or the local authority.



specially important when poisonous dips are used in order to avoid risk of injury to sheep through accumulation of poisonous matter. Under no circumstances, however, should the lime be added to the liquid while it is still in the bath;

(7) If an arsenical dip is used for the first dipping it is advisable to use a non-poisonous dip at full strength for the second dipping, but if arsenical dips are used for both dippings, the second dipping should be at half the strength of the first dipping.

Persons using poisonous dips must take the precautions necessary for the avoidance of accidents or injury to sheep through the use of such dips, and the Ministry will not entertain any claim for compensation for injury or loss due to their use. The choice of an approved dip rests entirely with the user. The responsibility for the class of ingredients is a matter for the manufacturer of the dip. The approval of the Ministry only means that the ingredients of a dip are effective for scab in the proportions approved.

The new Order\* does not supersede, but is an addition to, the existing Sheep Scab Order of 1920, which prescribes the procedure to be followed in connection with individual outbreaks of sheep scab, and requires all persons having under their charge any sheep affected with, or suspected of, sheep scab, to give notice of the fact immediately to the police.

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## CARNATIONS.

H. V. TAYLOR, A.R.C.Sc., B.Sc.,

*Deputy-Controller of Horticulture, Ministry of Agriculture  
and Fisheries.*

THE carnation has for many years been grown in large quantities by market gardeners for the sale of the cut blooms. Formerly these were obtained from the classes known as Border Carnations and Malmaisons, which produced blooms in abundance during the summer months only, and though in recent years the season for these has been somewhat lengthened by various cultural methods and a better selection of varieties, they fail to produce blooms over a period sufficient to meet the ever-increasing demand for the carnation. These Border Carnations and Malmaisons, though still cultivated to some extent, have been superseded by the class known as Tree or Perpetual Flowering Carnations. This type or class, when

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\* Single copies can be obtained from the Offices of the Ministry, 10 Whitehall Place, S.W.1., free of charge.

grown under glass, produces practically the whole year round choice blooms with long stems, which keep fresh for extended periods. These flowers are much in demand during all months of the year, and the commercial carnation industry has reached important dimensions.

This branch of flower growing during the past few years has increased in size and has become highly specialised. More glass-houses are being planted annually to carnations, so that the competition in markets is becoming keener each season, and should markets become overloaded with bloom, only those who are growing carnations exceptionally well are likely to succeed. The industry is not one for the novice to take up. It requires special training to acquire the necessary skill and manipulation, and it is an advantage to have a general experience in growing plants under glass.

**Propagation.**—The young plants are propagated from cuttings taken from the older plants, and much can be done to ensure healthy plants by taking the cuttings only from plants specially marked either for extra colour in the bloom, for general health and vigour of the plants, or for productiveness. In this way the standard stock of any variety may be retained or may even be improved.

The cuttings are obtained by cutting or pulling off the side shoots from the stems, just below where the blooms are cut, in such a manner that a shoot from 3 to 4 in. is obtained with a heel, though this latter is not absolutely necessary. In making the cutting it may be necessary to remove 2 or 3 pairs of the small leaves, though in the case of longer jointed shoots, it may only be necessary to remove one pair—this to secure a clean stem to insert in the propagating medium. The months from November to February are the best for propagation, though it may be carried out almost at any time provided the right class of cutting can be secured. Carnation cuttings root very freely if given the right conditions.

The cuttings must not be allowed to flag before being inserted in the propagating bed, which is composed of pure sand 2 in. in depth, and made quite firm. It is convenient to have the cuttings at intervals of 2 in. in rows 3 to 4 in. apart according to the size of the cuttings.

After insertion, one good watering in should be given and the lights closed, and if necessary shaded for a few days from strong sun, but rarely is it necessary to shade during the winter



months. The pit which contains the propagating bed should be supplied with bottom heat of from 55°-60° F., the higher temperature being the maximum to which it is safe to go. The pit will require occasional ventilation and watering.

In two or three weeks' time the roots will appear, and as these develop, additional air may be admitted stage by stage until the young plants will stand the lights being entirely removed without flagging. The cuttings are now ready for potting and no time should be lost in getting the rooted cuttings planted in pots of size 60 in a fairly good loam made porous by the addition of sand, brick rubbish, or ballast. After this stage the compost should be free working but not too rich.

The pots should be placed on benches or stages in a glass-house kept at about the same temperature and as near as possible the same atmospheric conditions as the propagating house. Light overhead spraying should be given for a few days, and water supplied at the roots when the general condition of the soil seems to warrant it. The temperature of the house meanwhile should not exceed (by fire heat) 50° F. As soon as the young plants have passed the danger from flagging (and this will be as soon as the roots have spread in the fresh soil) air may be admitted. If the atmosphere of the house and general conditions are correct, no shading will be necessary unless propagation has been delayed till quite late in the season. As growth proceeds and the plants develop, more room will be needed and some spacing must be arranged.

**Stopping.**—It is usual during the early stages of growth and whilst the plants are in 60 pots, to resort to "stopping" to induce the plants to throw out side growths. This is done by removing the growing point down to about the fourth pair of leaves. Some good growers favour the removal only of the appearing flower spike. The former practice gives a bushy plant, but if the latter procedure is practised the side growths appear higher up on the stem. After this "stopping" has been done the plants should grow into sturdy bushy little plants ready for planting out (a) into larger pots, or (b) into prepared beds in the carnation house.

**Re-potting into 48s'.**—If the former method of culture in pots is favoured then the plants must be re-potted into 48s' in good loamy soil to which 10 per cent. of well-rotted manure and  $\frac{1}{2}$  per cent. of fine bone meal have been added. Generally the young plants should be ready from about the 1st of March

onward for transferring into 48s', where they may remain for about two months.

**Re-potting into Flowering Pots.**—As they become ready they should be finally re-potted into pots of size 24 in soil a little richer than that advised for 48s'. It is an advantage to use soil as coarse as can be conveniently placed between the ball of the plant and the side of the pot without damaging the former. Firm potting is essential. The stem of the plant should not be buried too low, or stem rot may become a source of trouble.

It is the common practice to stand the plants out of doors from about the 1st of June to September, re-housing them just before they come into bloom; but whilst this practice gives economy of labour and housing, it does not produce blooms as fine as those from plants that have been kept under glass and protected from adverse weather conditions. The carnation plants under glass must be given all the air possible and must be watered, not heavily but generously, while on all really hot days the atmosphere of the houses must be kept as cool as possible by frequent damping of the floor, stages, etc. Feeding with manure should not be necessary until well on in the summer.

**Planting out in Beds.**—Though considerable success may be attained by cultivating and flowering the plants in pots, this method is now very largely superseded by growing the plants in prepared beds of soil in large and well-ventilated glass-houses.

Where beds have to be made up, large quantities of soil are not necessary, 4 to 6 in. of compost being sufficient to carry the plants 2 or 3 years, with an occasional light top dressing of soil and artificial manure.

Good maiden loam enriched with well-rotted manure and some bone meal (say, 1 per cent.) is about the best compost, though it should be of a fairly porous nature, as any tendency towards sourness during the winter months is detrimental. This soil should be raised some few inches above the ground by means of bricks, tiles, clinkers, or anything else of a porous nature to provide good drainage and aeration.

The plants from 60s' should be put in beds during April, and treated as advised for pots. If there is likely to be some delay in preparing the beds the plants should be re-potted into 54s' or even into 48s', but there appears to be a distinct advantage to be gained by early planting.



When planting, the ball of soil should be kept as near the surface as possible without actually exposing it, and above all, the planting must be *firm*.

The young plants must be watered carefully until they have their roots well established throughout the whole bulk of soil, when the supply may be more generous. Similar care with ventilation is necessary for the first week or two after planting; but once the young plants have become established, practically full ventilation can be given until September, by which time the flower buds will be showing, the nights will become colder and the atmosphere damper, so that a different line of treatment will be necessary.

With the first cold spell in September, fire heat will be necessary, so as to maintain a fairly dry and buoyant atmosphere. A high temperature is not necessary and must be avoided, so that fire heat can and should be dispensed with whenever possible. In dry weather the temperature can be kept from 46° to 50° F. with just a little fire heat, though on the other hand it may be advisable to fire with the glass outside at, say, 50° F. or even higher to secure the proper atmospheric conditions inside the house.

**Disbudding.**—Practically all carnations are now sold on single stems, *i.e.*, without any of the secondary buds being left on, so that as the flower stem advances all side buds must be removed; the proper stage to do this is when such buds can be removed readily with the downward movement of one finger, if attempted too early it is quite a tiresome operation and many of the centre buds are liable to be damaged or broken.

Some varieties, such as White Wonder, at certain seasons of the year are apt to give flat or deformed buds, and growers must look out for this. If the disbudding is performed too early it may mean that only the centre and deformed bud is left, but experience should soon teach the grower with which varieties and at what season trouble is likely to occur, and at such times the disbudding should be left till it can be seen that the centre bud is perfect—if not, it must be removed and one of the side buds allowed to develop in its place. On the other hand, in ordinary circumstances disbudding must not be left too long or it will result in the loss of size in the bloom.

**Pests.**—In common with all other plants the perpetual carnation is subject to various pests, both fungoid and insect, and to keep them as free as possible, all details of cultivation must

be carefully observed and carried out at the proper season, but with every care occasional sprayings and fumigations will be necessary to keep the plants clean.

**Varieties.**—When selecting varieties for market purposes due consideration must be given to the requirements of the particular markets that are to be served.

In the case of sales direct to the consumer or to the smaller florists the choice of varieties is not of such paramount importance, and many more varieties may be grown and sold at a profit in this way than when sending to a large market, which usually wants a bulk of good standard varieties and chiefly self colours, such as Pink, Salmon Pink, Cerise, White, Scarlet, and Crimson, with a very much smaller percentage of Yellow, Mauve and Fancy varieties.

It is impossible to state exactly what are the best varieties to suit all soils and situations; varieties that do well in one soil or locality may not succeed to the same extent in another, possibly only a few miles away, but the following list is a selection of the best in the various colours:—

*Pink.*

Mayday  
Mrs. Walter Hemus  
Enchantress Supreme

*Salmon Pink.*

Lady Northcliffe  
Bona  
Cupid  
Laddie

*Scarlet.*

Aviator  
Tarzan  
Beacon  
Edward Allwood

*White.*

White Wonder  
Wivelsfield White  
White Mayday.

*Crimson.*

Triumph  
Carola  
Nigger

*Cerise.*

Peerless  
Mrs. C. W. Ward  
Rosette

*Mauve.*

Mikado  
Eastern Maid  
Wivelsfield Claret

*Fancies.*

Wivelsfield Beauty  
Benora  
Jazz  
Wivelsfield Apricot  
Circe  
Bishton Wonder

*Yellow.*

Saffron  
Maine Sunshine.

**Marketing the Bloom.**—The flowers should be cut before they are fully developed, and probably the best time to do this is in the early morning. The gathered blooms are taken to the packing shed and placed in deep tins containing clean water. Next comes the process of grading, and this is done by women and girls who sort out the blooms in best and



second grades, quickly returning them to the water where they remain till packed for the market. The graded blooms are packed in special wooden boxes, 3 ft. long  $\times$  8 to 9 in. broad and  $4\frac{1}{2}$  in. deep, lined with tissue paper. The number of blooms packed in each box varies according to the grade and the season of the year—2, 3 or 4 dozen is the usual quantity for the best grades, while the seconds or worst grades are often packed in bunches each of 12 blooms. The blooms are held in position with a cross stick.

A label showing the quantity of blooms and the grade should be attached to the end of the box to enable the salesmen and buyer to judge as to the contents without opening the box, thus facilitating trading and distribution. The blooms are needed for their beauty, and it is important to remember that this may become wholly or partially destroyed through faulty packing.

The writer wishes to acknowledge the generous help and assistance given by Mr. Stevenson of Messrs. Lowe & Shawyer.

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## AGRICULTURE AS A CAREER FOR BOYS.

G. W. OLIVE, M.A.,

*Headmaster, Dauntsey Agricultural School.*

AGRICULTURE as a career offers many attractions. It presents many possibilities and many problems which must be carefully considered before any venture is made. To be successful the farmer must not only be well educated, but also essentially practical, being capable of taking his place in the daily routine of farm work, showing the labourers he can work, and means to do so, and expects them to do likewise. Wide experience, sound judgment, careful training, a good education, and businesslike methods are essential to the modern farmer.

Agriculture opens up a variety of careers. In Great Britain farming may take the form of general farming, or general farming with some specializing in certain breeds of live stock or varieties of crops—or definitely specialized farming, such as dairy farming, pig rearing, fruit and vegetable growing, poultry farming, etc. Abroad, the same general division of the types of farming holds, but the specialized type is of frequent occurrence, *e.g.*: tea planting, cattle rearing, sheep farming, etc. Throughout the Empire there is vast scope. South Africa,

Rhodesia, Australia, and New Zealand demand that the prospective farmer shall possess adequate capital. Canada makes no specific stipulation. Representatives of the Dominions will readily supply full information.

For the development and organisation of the manifold activities of such a great industry as agriculture, officials are appointed by the Ministry of Agriculture, and by the county and similar authorities. Research workers are required for the large mass of important research that awaits them at such Experimental Stations as Rothamsted, the Universities. Agricultural Colleges, as well as at private laboratories.

Large and progressive commercial firms, such as "Company Farming" enterprises, seed merchants, firms who make feeding stuffs and artificial manures, textile firms, agricultural engineers, etc., have their staffs of experts, and are generous to really good men who can combine theory with practice in a fruitful way to the elucidation of the many problems that present themselves in this kind of work. Capable men can look to appointments, under Government or otherwise, both at home and abroad.

Finally, there is the demand for able lecturers in Universities, Colleges and Schools.

**General Education.**—It should be clearly understood that a good general education is just as essential for the boy who proposes to be a farmer as for any other boy, because a broad education will make him a better farmer and a better man. In successful farming a sum equal to 100 per cent. of the capital invested may be turned over in a year. This may mean a turn-over of many thousands, and success demands a man of education at the head of affairs. It also demands a man of real knowledge, which is not merely book knowledge, but practical experience, coupled with scientific training. There is no substitute for practical experience. School and college may prepare the way for more enlightened, more progressive, more successful work, by the farmer or by the agricultural scientist, but to each of them practical experience is essential, and this experience is not obtainable except "by the sweat of the brow." Unfortunately, this fact is frequently misinterpreted as a reason for neglecting the general education, for the premature withdrawal of a boy from school, or for specializing in agricultural subjects at too early an age.

It is agreed then, that the boy must be well educated. At school he should certainly learn science, with engineering and



woodwork if possible. During his school days—say till 16 to 18 years of age—the future agriculturist should have been spending much of his holidays on farms. If the boy has been at a school where agriculture has been well taught, he is now in a position to make a start in life by commencing as a farm pupil. But such schools are not common, so the boy should, in most cases, go to a Farm Institute or an Agricultural College, or the Agricultural Department of a University for a sound course of instruction. If the boy intends to do this, he should arrange to pass any necessary examination before leaving school, and at such a time as will enable him first of all to spend at least twelve months working on a farm.

**Agricultural Education.**—No one doubts the value of agricultural education. It enables the agriculturist to move with the times, it broadens his views, and it provides that valuable knowledge of the fundamental principles upon which agriculture rests. There is too much loss occasioned by the time-lag between the liberation of new knowledge and its application. There is too much hesitation in trying new ideas, and too little ability to profit by the object lessons provided by others. Agricultural education prepares the way for progress. The scientific man opens the book of knowledge. It is for the farmer to read and to learn and to profit the world and himself by the knowledge. A scheme of education that provides nothing better than “half-baked scientist farmers” is not agricultural education, nor does it advance the cause of agriculture.

There is no lack of opportunity of obtaining agricultural education throughout the country, and for convenience of description, the types of agricultural education available will be described under four headings: (1) College or University, (2) Farm Institutes, (3) Local Courses, (4) Schools with Agricultural Departments.

1. *College or University.*—Gives a course of 2, 3 or 4 years to men who intend to become landowners, occupiers or managers of large farms, land agents, lecturers, officials, etc.

The colleges demand a sound preliminary general and scientific education.

For details, apply to the Ministry for a copy of Leaflet No. 197.

2. *The Farm Institute.*—This is intended for the instruction of sons of smaller farmers, bailiffs, etc., who cannot leave the farm for the whole of the year, but can take short courses of instruction in the winter months. The course provides fundamental technical instruction, which will put those following the

course in touch with modern methods of farming. It also enables them to take advantage of information and advice provided by the Ministry, by books, and by the technical press. For details apply to the Ministry for Form 732/T.E. and Leaflet No. 197.

3. *Local Courses*.—These aim at bringing instruction to workers on the land by means of evening or day classes, lectures, demonstrations, or manual instruction classes in the various skilled operations of the farm. Courses in agriculture, dairying, veterinary hygiene, horticulture, fruit growing, poultry keeping, instruction in agricultural processes (hedging, ditching, ploughing, etc.) are usually provided free or at a nominal charge by County Agricultural Committees or similar Local Authorities. Details are obtainable on application to the Agricultural Organiser or to the Secretary, at the Office of the County Council.

4. *Schools with Agricultural Departments*.—There are a few Schools in the country which, besides giving a good general education, provide for considerable specialization in agricultural subjects. These schools vary in character, and more exact information may be obtained by application to the Headmaster or Principal of the school or to the Board of Education.

The following schools specialise, more or less, in agricultural subjects:—

1. Dauntsey Agricultural School, West Lavington, Wiltshire.
2. Sexey's School, Blackford, Wedmore, Somerset.
3. Brewood Grammar School, Staffordshire.
4. North Eastern County School, Barnard Castle, Durham.

**Free Agricultural Education—Scholarship Scheme.**—Exceptional opportunities are provided for boys and girls who intend to take up an agricultural or allied pursuit. Scholarships are offered by the majority of County Councils, which enable suitable students to attend courses at University Departments of Agriculture, Agricultural Colleges and Farm Institutes. These scholarships are awarded to residents in the respective counties, and particulars may be obtained by application to the County Council concerned.

Scholarships are also offered by the Ministry of Agriculture and Fisheries, but the beneficiaries under this scheme are limited to the sons and daughters of agricultural and rural workers. The scholarships are of three types:—*Class I* scholarships enable students to attend degree and post-graduate diploma courses at Agricultural Departments of Universities, or, in the case of veterinary science, at the Royal Veterinary College, London;



*Class II* scholarships enable students to attend a two-years' course in agriculture, dairying, horticulture, or poultry-keeping, at University Departments of Agriculture and Agricultural Colleges; *Class III* scholarships enable students to attend courses of one year's duration or less in agriculture, horticulture, poultry-keeping or dairying, and are tenable, for the most part, at Farm Institutes. Under the scheme, 10 scholarships each of Classes I and II and from 100 to 150 of Class III may be awarded by the Ministry each year. Further particulars can be obtained on application to the Ministry.

**Practical Training and Experience.**—No one should think of starting to farm on his own account until he has had practical experience for at least two or three years after leaving school or college. He must learn not only to plough, harrow, mow, reap, hedge and ditch, and perform every other agricultural operation or process, but also to determine just when these operations will achieve the best results. He must learn to manage the live stock of a farm. In all probability this experience is best obtained on a good mixed farm—not too large—where he works as a farm labourer would, and where he gives a hand with everything. After this stage a knowledge of farm managing and marketing is needed, and for this purpose, he should try to go as a pupil on a rather larger farm, under a sound practical man who is willing to take the pupil about with him round the farm, and to market, and explain his methods. It must be remembered, too, that only a few of those farmers whose characters, abilities and business methods are outstanding, have either the inclination or capacity to impart the knowledge they possess. The selection, by the parent, of the farmer who will guide the boy is all-important, and in this matter the County Agricultural Organiser may be in a position to offer valuable advice. Big premiums do not necessarily buy valuable experience, though it can seldom be obtained without being well paid for.

Finally, before starting to farm, the future farmer should endeavour to obtain experience for at least two years, in a responsible position, in the actual kind of farming he proposes to take up, and preferably in the part of the country where he is going to farm. Soil, climate, markets, local practices, etc., vary a great deal, and the knowledge of the relation between these factors and the mode of farming is essential before success can be achieved. The premiums required by farmers and others to take pupils also vary. In a few cases

a farmer is willing to take a pupil, more or less as a return for the work done by him, but as a rule the farmer requires an adequate premium, and also demands that the pupil shall be a worker, and mean business. A pupil who finds his own lodgings may have to pay any sum from £50 to £150 per annum, the amount varying, of course, with the circumstances of the pupilage. If the pupil lives in the farmer's house, the amount may vary from £100 to £250. It should be remembered, however, that this apprenticeship is a most important part of the boy's training, and that the thing that really matters is for the boy to receive the sound preparation so vital to the success of his future career.

**Prospects: Capital.**—It must be set down at the outset that, at the time of writing, the prospects of farming are none too rosy, and that the question of capital is all-important.

A farmer who knows his business, and is not unduly hampered by lack of capital or unfavourable conditions, will be able to make a living, provided that he is prepared to work hard for long hours, practically every day of the year. There are light and heavy seasons, but if he is of the right sort, he will get his recreation out of his farming. If, however, he is so constituted as to require a comparatively high standard of living and leisure apart from his farm, he had better take up some other occupation.

It is quite impossible to speak with certainty on the prospects of farming, or to give any definite figures as to the capital required. So much depends upon the fluctuating conditions of the day and on the personal factor. Agriculture is passing through a difficult period, and what the future holds nobody can say.

Some parents who are considering farming as a career for their sons are fully aware of every aspect of the financial side of the business, but there are others who do not possess this knowledge, and for their benefit the following generalisation and figures are presented, which, however, must be read with all caution and accepted as a rough guide for the present time only.

Small farms are severely handicapped by high capitalisations and heavy expenditure, particularly in rent, rates and labour, together with certain difficulties in marketing.

In the last year or so profits have been made on farms which are almost entirely grass and have maintained dairy rather than grazing herds. Those that are half arable and half grass



have little more than held their own, while heavy losses were, in many cases, made on arable farms. These results have been largely affected by the drop in values, which has occurred during the last two years. (In 1922 it may be specially noted that not only was the price of corn poor, but the yield also.) However, labour and commodities which the farmer has to buy are becoming cheaper—facts which help to counteract the effect of low prices.

The capital required to take a farm is about £15 an acre for ordinary farming, or, calculated on a different basis, the capital required is at least ten times the rent for ordinary farming, and more for specialized farming. In a few instances, as in the case of large farms and chalk farms, the figures may be somewhat less than those given above, but generally speaking, it will be dangerous not to assume these figures as the minima. The capital required will vary to a very appreciable extent with the locality, the type of farming, and other circumstances. The fact that there must be ample capital at the back of the prospective farmer cannot be too strongly emphasised—to start farming with insufficient capital is to court failure.

There is little to be gained by training a boy without access to capital, for large scale farming. There are as yet comparatively few openings in Great Britain, for a clever boy without money to get a footing in the business of farming by beginning in a lowly paid post, and developing into a manager. Such a boy may possibly become an official or expert, but he stands little chance of becoming a farmer on his own. However, he can go abroad into the colonies and do well.

**Starting the Career.**—In choosing a farm, and in dealing with the difficulties which will inevitably arise when he starts on his own, a young farmer should obtain, if possible, the advice of a really good, trustworthy, practical farmer in the district. The struggle will be his own, and he must face it, but good advice should always be sought and followed when it is available.

The candidate for research, organizing, teaching, and expert posts, may be safely left in the hands of University and College Authorities. The good, keen man will always be noted.

**Branches of Practical Agriculture other than Farming.**—There are several careers nearly allied to that of farming, in which a livelihood can be obtained from the land, such as market gardening, fruit and flower growing, nursery gardening, etc. As in the case of farming, knowledge, experience, energy, business capacity, and other qualities are essential to success,

and special consideration must be given to markets, situation, soil, climate, labour, and other factors, before a holding is decided upon. The capital outlay is very variable, and it must be remembered that in the specialized industries mentioned the capital required per acre tends to be higher—however, the acreage required is often relatively small. It is well known that many have found in this kind of work a congenial and remunerative mode of life.

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## SAINFOIN.

SAINFOIN (*Onobrychis sativa*) is a leguminous forage plant, which is believed to be truly indigenous on chalk and limestone soils in the South and South-east of England. The common cultivated variety is said to have been introduced from France about the middle of the 17th century.

The plant has pinnate leaves and racemes of pink flowers on long stalks. The fruit is a single-seeded pod, easily recognised by the net-veined markings on the surface. The seed is bean-shaped and about three times as large as red clover seed.

**Varieties and Their Uses.**—There are two varieties in commerce, viz. : (1) Common Sainfoin, (2) Giant Sainfoin.

*Common Sainfoin* is a slightly smaller and much longer-lived plant than the giant variety, and is often used in temporary and permanent pasture mixtures on soils which are fairly rich in lime.

As a rotation crop, common sainfoin may be cut for hay and the aftermath grazed for sheep. As a sheep food the young herbage of sainfoin compares very favourably with that of any other forage crop, more especially for finishing off sheep for market.

It generally attains a height of about two feet and flowers normally in late May or during June. Common sainfoin is usually at its best about the third year; but under suitable conditions it may be allowed to stand for 5, 7 or even 10 years.

*Giant Sainfoin* was introduced from France, and there are records of its being grown near Baldock (Herts) as early as 1832. It is shorter lived and more luxuriant in growth than common sainfoin and can give two cuts of hay during the year; hence it is suitable for rotation cropping. It is not usually



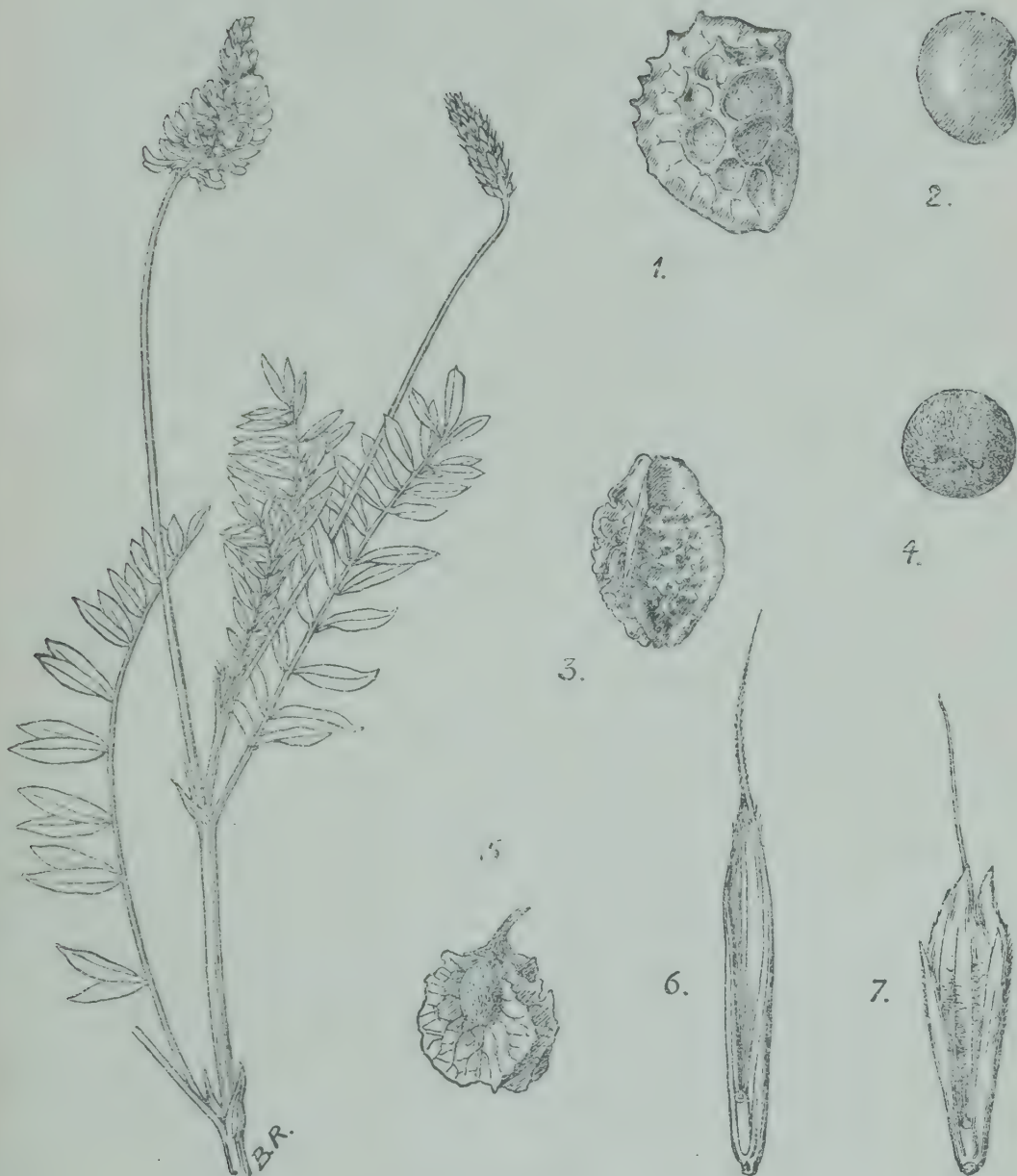


Plate I.—SAINFOIN (*Onobrychis sativa*, Lam.).

*Seeds in Sainfoin Samples, all  $\times 3$ .*

1. Sainfoin, unmilled.
2. „ milled.
3. Burnet (*Poterium Sanguisorba*, Linn.).
4. Cleavers (hooks rubbed off) (*Galium Aparine*, Linn.).
5. Dock sp. (*Rumex* sp.).
6. Barren Brome (*Bromus sterilis*, Linn.).
7. Field Brome (*Bromus arvensis*, Linn.).

left down for more than two seasons. It is a useful alternative crop to clover on those soils in the south and south-eastern counties of England where it can be grown successfully.\*

**Soil and Climate.**—Although sainfoin seems to prefer light soils containing a considerable percentage of lime, it is adaptable to a much wider range of conditions than is generally believed to be the case. Good crops are grown both on clays and loams in districts where the climate is dry and warm. Under suitable conditions the primary root descends to a great depth, and the plant is able to withstand the severest drought, being almost independent of surface moisture. Stagnant water, however, is fatal to the success of the crop. On the poorer and lighter classes of soil, sainfoin contributes very materially to the success of subsequent crops. Barley, for instance, follows it with great advantage and on thin, dry soils unsuitable for turnips, rape and mustard may often be successfully grown after sainfoin.

**Preparing the Seed-Bed.**—The cultural conditions best suited to the growth of sainfoin are practically the same as for lucerne.† The soil should be clean and in good heart; the sub-soil well-drained and readily penetrable by the tap-root.

**Seed and Method of Sowing.**—The seed of commerce may be obtained in the husk (unmilled) or with the husk removed (milled). The use for seed purposes of milled sainfoin has advantages over the use of sainfoin in husk. In some districts there may be a prejudice against the use of milled seed, the opinion being held that stocks of the old common sainfoin are more likely to be genuine if obtained in the husk. There does not, however, nowadays appear to be any grounds for this belief. Evidence that has accumulated at the Official Seed Testing Station shows that higher purity and germination will usually be obtained from milled than unmilled seed.

The purity of sainfoin in husk is on the average one or two per cent. lower than that of milled seed. Moreover, the nature of the impurity is different. It is difficult entirely to eliminate brome grass, burnet or similar large seeds from unmilled sainfoin, whereas the impurity in the milled seed consists usually of broken fragments of seed.

Unmilled sainfoin always contains a small proportion of husks which are either entirely empty or which contain partially

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\* Sainfoin is believed not to be susceptible to Stem Eelworm. It is susceptible, especially the first year, to Clover Stem Rot, and occasionally is attacked severely. See Leaflets No. 46, *Stem Eelworm*, and No. 271, *Clover Stem Rot*.

† See Leaflet No. 160, *The Cultivation of Lucerne*.



developed seeds. These would be eliminated by milling. Also a healthy seed may have great difficulty in breaking through the husk and may die in the process. It will be clear, therefore, that, other things being equal, a milled sample of seed will have a higher germination than the same sample in husk.

The milled seed has a smooth surface, is kidney-shaped, and in good samples is plump and yellowish-grey or light brown in colour outside and of a greenish tint inside. When black or shrivelled it has been spoilt either by bad harvesting or old age, and perhaps by a combination of both. Only fresh coloured seed should be sown and all old or discoloured seed discarded.\*

The seed is drilled in 7 in. to 12 in. rows, at right angles to the corn or other cover crop from February to May a little deeper than clover seed. The land should be in good heart and for this reason is often in corn after a root crop fed off with sheep. The corn crop should be sown thinly (about  $1\frac{1}{2}$  bushels per acre) with a corn drill, and in spring-sown corn the sainfoin may be sown immediately after with the same corn drill. In this case the drills will be approximately 7 in. wide, with the result that subsequent intercultivation will not be quite so easy as with a slightly wider drill. When the corn or cover crop has been sown in the autumn, there might be more difficulty in getting a sufficiently good tilth in spring for the sainfoin, and in such cases it is often advisable to use a disc drill, so as to get the seed in sufficiently deep to be properly covered. In the case of common sainfoin, which is intended to occupy the ground for a number of years, the soil should be free from weeds and it may even be advisable in some cases to sow this variety without a covering crop. Four bushels of unmilled seed or 56 lb. of milled seed per acre is the customary rate of sowing. It is usual to grow sainfoin pure in the Eastern Counties, but on chalk or limestone in the South and West of England it is often used as a constituent of a mixture for temporary or permanent leys. A mixture of giant sainfoin, red clover and Italian rye grass makes excellent hay.

**Manuring.**—When practicable a dressing of very short dung, i.e., thoroughly rotted to destroy weeds, given during the first autumn, helps the plant in the early stages, and is, moreover, a protection against frost. This should be followed in the spring

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\* As regards the provisions of the Seeds Act, 1920, and the Seeds Regulations, 1920, and also as to the facilities offered to farmers by the Official Seed Testing Station, Huntingdon Road, Cambridge, see Form No. 728/C.S., obtainable from the Ministry.

with a dressing of 2 to 3 cwt. of superphosphate and 2 to 3 cwt. of kainit per acre.

If the sainfoin continues to be cut for hay the above dressing of superphosphate and kainit should, generally speaking, be continued each year, although a further dressing of farmyard manure would be useful after an interval of three or four years.

**Cutting the Crop for Hay.**—*It is important that cutting for hay should start directly flowering commences*, as the plant is then at its best for feeding purposes, and each day's delay impairs both the quality of the hay and the future yield of the plant. It should be handled with great care, like lucerne and clover, to avoid breaking off the fine leaf; but it is not readily spoiled, if left unturned, even in wet weather. A yield of 30 to 40 cwt. of hay per acre is considered an average crop. In the case of giant sainfoin two crops of hay are often mown the first year after sowing, while seed is generally taken from the second crop in the second year, before ploughing up. Common sainfoin is usually cut for seed in its last year, before ploughing up, but a seed crop may be taken in any year except the year after sowing. When allowed to ripen for seed, cutting takes place in July or August, as soon as the lower seeds are fully ripe, and the crop is carefully dried before being stacked. In order to prevent shedding of mature seed, it is desirable to cut the seed crop either early in the morning or late in the afternoon, when the plants are not too dry. In a good season 25 to 30 bushels of seed in the husk may be obtained per acre.

If it be intended to keep the crop down for several years, it is usual to cut sainfoin for hay in the first year in order to encourage deep rooting; afterwards it may be mown or grazed as circumstances require. Whether as hay or as green forage it is an admirable food for all fattening and breeding stock, and is regarded as the best possible change for stock which may not be thriving on ordinary pastures.

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## THREE NEW DISEASES OF THE HOP.

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In the following article, three fungous diseases of the hop, new to this country, are described. The first disease, the "Downy Mildew," is an introduction from Japan or from America, and its potentiality as a dangerous disease may be



gauged from the fact that the fungus is included amongst those legislated against in the "Destructive Insects and Pests Order of 1922." The second disease, the "Leaf-spot," causes a "spotting" of the hop-leaf, and has, so far, not been observed to cause any serious injury; the fungus concerned was found to be a species of *Cercospora* new to science. The third disease, to which the name "Hop-drop" has been given, is associated with the presence of a minute fungus (*Macrosporium*) which attacks the stalk of the cone, "eating" it through and causing the cone to fall to the ground.

1. **Downy Mildew** (*Pseudoperonospora Humuli* (Miyabe and Takah.) Wils.).—In October, 1920, when examining, in the experimental hop-garden at Wye College, a number of seedling hops raised from seed of the "wild hop" (*Humulus Lupulus* L.) obtained from Italy, we noticed that on some of the plants the leaves were spotted in an unusual manner, the characteristic feature of the spots being their angular outline. The spots were dark brown above and paler on the under-surface of the leaf. When the lower surface of the leaf was examined with a lens, a blackish-grey "mould" was visible on the discoloured areas, and under the microscope the "mould" revealed itself as composed of the branched fructifications of a "Downy Mildew" (*Peronosporaceae*). At the tip of the branches fruit-bodies (*sporangia*) were borne; each of these, placed in a drop of water, produced in the course of 2 or 3 hours a number of actively motile *spores* (*zoospores*) which swam about in the water until finally they settled down and began to germinate by putting out a short germ-tube. When this took place on a hop-leaf, the germ-tube entered the leaf, formed a *mycelium* within it, and gave rise after a few days to the fruiting-stage of the fungus.

Although a search was made for the fungus on the same plants and elsewhere in the experimental hop-garden in 1921 (a very dry season), it could not be found, but early in September, 1922 (a very wet season), it reappeared, both on the leaves of a considerable number of seedling hop-plants of various origin, and on the hop-cones of several of the plants. On the leaf the disease was again characterised by the angular outline of the spots (*Fig. 1*). On the hop-cone, the bracteoles were attacked first, and this gave the hops in many cases a striped appearance, the vertical rows of dark brown bracteoles (which withered under the attack) alternating with the bracts which were still green (*Fig. 2*). Later in the same year (October) another form of fructification of the fungus was found, viz., resting spores

(oospores)—rounded bodies, thick-walled and measuring 28-34  $\mu$  in diam.—formed by the spawn (*mycelium*) of the fungus in the substance of the leaves just below the lower epidermis. These resting-spores falling to the ground with the leaves would remain alive until the following season and germinating then, would thus perpetuate the disease from year to year.

When the disease was found again in 1922, and both forms of its fructification obtained, it was suspected to be the species of "Downy Mildew" described in 1905 as occurring on the hop in Japan, and named *Peronoplasmodium Humuli* by Miyabe and Takahashi.\* This supposition was found to be correct when, later, we were able to examine authentic specimens of the fungus from Japan sent to us by Prof. Kingo Miyabe.

Since the present disease is one of which hopgrowers in this country have had no experience, it will be of interest to give here an account of the disease as it has been observed in other countries. The following extract\* relates to its original discovery in Japan: "It was in the early summer of 1905 that our attention was first drawn to a diseased appearance of the leaves of the cultivated hop-vines in the experimental plot of the Hokkaido Agricultural Experiment Station in Sapporo. An examination showed at once that it was due to a kind of 'downy mildew.' . . . In the hop-field belonging to the Sapporo Brewery Company a careful search was made on June 15 this year (1905), and we found the mildew to have already begun to spread to an alarming extent throughout the field. A portion of the field adjoining the place where the hop-vines were collected and burnt the previous autumn was very badly attacked. The lower leaves of the vine [bine] were at that time most infected, but the disease had already spread to some of the upper leaves. Judging from the extent to which the fungus had spread in the field, we may safely infer that the disease had existed there for many years without drawing attention. Messrs. S. Fujita and J. Kasaharae, of the Company, struck with the seriousness of the case at once took active measures to combat the disease. By thoroughly spraying with Bordeaux mixture and by systematic picking of the affected leaves, they were able to prevent the spread of the disease for the rest of the year."

The fungus has been found also in Japan on the wild hop, *Humulus Lupulus* var. *cordifolius*, indigenous to that country, and Prof. K. Miyabe remarks (*l.c.*): "These facts prove beyond

\* K. Miyabe and Y. Takahashi: in *Trans. Sapporo Nat. Hist. Soc.*, I, part 2, (1905-6).





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FIG. 1.—Hop Leaf showing the Angular Spots caused by the Downy Mildew (*Pseudoperonospora Humuli*) (Nat. size).

FIG. 2.—Hop-cones attacked by Downy Mildew ; the bracteoles are attacked before the bracts, so that the discoloration often appears in vertical stripes as seen in the middle cone (Nat. size).



FIG. 3.—Hop leaf attacked by the “Leaf-spot” disease caused by *Cercospora cantuariensis* (Nat. size).

FIG. 4.—Hop-cones showing the stage in the “Hop-drop” disease when a brown, discoloured mark is seen near the middle of the stalk; later the hops become detached at that point and fall (Nat. size).



doubt that the mildew is indigenous to this country growing on the wild hop-vine, and has recently found a more congenial host in the cultivated hop-vines introduced from America and Europe."

In a letter received recently from Prof. Miyabe, the following additional information is given: "The mildew attacks the cones of the cultivated hop, making them quite worthless. I have found the fungus on *Humulus japonicus* too."

In 1909 a "downy mildew" was observed\* by Dr. J. J. Davis on the "wild hop," in the State of Wisconsin, in North America. In a letter sent to us in 1921, Dr. Davis writes that he met with the fungus (which he has identified as the same species (*Pseudoperonospora Humuli*) described from Japan) again in the previous summer in the north-eastern part of the State, and adds: "I do not doubt that it is indigenous."

The manner of introduction of the "downy mildew" of the hop into this country is unknown. Roots and seeds of the wild hop of Japan (*H. Lupulus* var. *cordifolius*) were obtained in 1917 from Japan and planted in the experimental hop garden at Wye College, but the "downy mildew" carefully searched for each season since 1920, has never been found on plants of this origin. If the fungus is indigenous to the United States, as has been asserted, there exists the possibility that the downy mildew has been introduced into this country on hop plants obtained from America.

There is also the possibility that the garden plant, *Humulus japonicus*, which is grown not infrequently in England as an ornamental climbing plant, has been the means of introducing the fungus on imported seeds.

It is much to be feared that in wet seasons the "downy mildew" of the hop may prove a dangerous enemy. On the first appearance of it on the hop plant, the affected leaves should be picked off and taken away from the hop garden and burned; the whole plant should then be well sprayed with Bordeaux mixture.

Any outbreak of the "downy mildew" of the hop should be at once reported to the Ministry of Agriculture.

**2. Hop Leaf-Spot.**—A disease, in the form of spots or blotches on the leaves, was noticed in September, 1922, in a

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\* Dr. J. J. Davis, "A New Hop Mildew" (*Science*, n.s., Vol. XXXI, 752 (1910)).

hop-garden, of the Canterbury Golding variety, near Canterbury. The spot caused by the disease was circular in general outline (Fig. 3), with a greyish (almost white) central portion,  $\frac{1}{20}$  to  $\frac{1}{5}$  in. diameter, bordered by a dark, purplish-brown line, outside which was a yellowish zone which gradually merged into the general green of the healthy parts. Where the spots were close together on the leaf the yellow zones coalesced to form large yellow areas. These colour characters were more conspicuous on the upper surface of the leaf than on the lower. With a pocket magnifying glass hair-like outgrowths were visible projecting from the lower surface of the spots. Under the microscope these were found to be the *spores* of a fungus belonging to the genus *Cercospora*\*; each spore was cylindrical, with tapering ends, pale brown in colour and divided by cross-walls into a variable number (5 to 14) of cells. The size of the *spore* is variable; the length is usually  $200\mu$  or more, and the width about  $14\mu$ .

Although no appreciable damage was observed to be caused to the hop plants on which this disease occurred, it appears desirable to record this new enemy of the hop, as other species of *Cercospora* are capable of causing very serious injury to the plants on which they occur.

3. **Hop-Drop.**—A disease, for which the name "hop-drop" is proposed, was met with in September, 1922, in a hop-garden near Canterbury. The disease manifested itself by causing a considerable number of the hop-cones to fall to the ground shortly before the hops in the gardens concerned were ready for picking. The varieties of hops affected were Cobbs and Canterbury Golding. An examination of the hop-plants showed some of the cones hanging loosely on brown stalks ready to fall, and others with various amounts of browning on the stalks, the first stage of the disease being evident as a brown discoloration on the stalk at about half an inch below the hop (Fig. 4).

A fungus was invariably present on the brown portions, bearing *spores* on short stalks; these *spores* were broad and rounded below, and narrowed towards the apex, pale brown in colour and divided into a number of cells by several transverse walls and usually also by a few longitudinal walls; they measured  $23-67 \times 10-15\mu$ .

The constant association of the fungus (*Macrosporium* sp.) with the brown discoloration on the stalks suggests that it is the

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\*The species proved to be new to Science, and has been named by us *Cercospora cantuariensis* (see *Journal of Botany*, Vol. 61, 134 (1923)).



cause of the trouble, but confirmation by inoculation experiments has not yet been possible. It seems probable that this fungus belongs to that class of parasites which are able to attack plants only when the latter are in a state of "physiological weakness," a condition likely to have been produced in the hop-plants in question by the cold and wet weather, accompanied by gales of wind, that occurred during early September last year.

Although in the above case the quantity of hop-cones which fell to the ground before picking-time and were lost was considerable, the disquieting effect on the mind of the farmer was considerable on seeing a portion of a crop on which several hundreds of pounds had been spent, falling to the ground and being wasted.

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## PERMANENT ALLOTMENTS: "SECURITY OF TENURE" AND HOW TO OBTAIN IT.

H. C. GOODALL,

*General Secretary, Addiscombe and Woodside Allotments Society  
(1921) Ltd., Croydon.*

THE one thing which is uppermost in the mind of most allotment holders is security of tenure. It is difficult to see how any allotment holder can be expected to produce the best possible results of which he may justly feel proud if he has the constant fear in his mind that one day, either now or in the near or distant future, his land will be taken from him for building or other purposes. This fear must be prejudicial to the cultivation of an allotment, and in this connection it should be remembered that an allotment provides a man with a form of recreation and undoubtedly tends, to a far greater extent than is generally supposed, to keep his mind and spare time occupied; it consequently helps to make him a contented citizen and thereby adds to the ordered state of the community of which we in England are able to boast to-day.

This being so, the following particulars of the work of the Addiscombe and Woodside Allotments Society (1921) Limited, of Croydon, may prove helpful and interesting to other Societies who are now occupying land for allotments, either on lease direct from private owners, from a local authority who have

hired the land, or in any other manner under which they are faced with the prospect of losing their ground when required for building or other purposes.

The Addiscombe and Woodside Society is believed to be the first society in the kingdom to acquire, with the assistance of the local authority, its own freehold. The executive of the Addiscombe Society decided at the end of 1920, when the society was still a war allotment society and as such not a registered society, that arrangements should be put in hand for finding a permanent home for their members when the war plots came to be given up.

It was obvious to the executive that all the grounds, about 8 in number, held at that time under D.O.R.A., and ranging from one acre to 12 acres in extent, would undoubtedly be developed as building land as soon as conditions became more normal. It was decided, therefore, to make a survey of the neighbourhood, and, if possible, concentrate on some ground, which, while actually not building land in the full sense of the term, would nevertheless be situate fairly centrally in the district, and thus be accessible for members of the society living in all parts of the district.

It should be explained here that Addiscombe, a part of Croydon, was before the War, and still is, being rapidly developed by the erection of middle-class houses. It was realised, therefore, that any ground which was in any way accessible in the district, would command a good price.

As a result of the survey, it was decided to focus attention on two fields of about 35 acres in extent, in the occupation of a local farmer. The extreme end of the ground—about 7 acres—was very wooded, and therefore unsuitable for allotment purposes. The next step was to approach the Local Authority, viz., the Corporation of Croydon, and urge that negotiations be started with the ultimate view of the society obtaining the freehold of the remaining 28 acres. How this was to come about was not clear to anyone at that time. In Croydon, however, allotment holders are fortunate in having a very sympathetic Small Holdings and Allotments Committee on the Council. This being so, negotiations were opened, but after a period of three months the society was notified by the Council that the price asked was prohibitive, and the figure named would have prevented the Society letting the plots at a reasonably low rent. The executive of the society further



considered the matter and decided that whatever obstacles were in the way must, if possible, be removed. The ground decided on was the only suitable ground in the district and it was felt that every effort should be made to obtain it. At the same time the executive realised that it would not be possible to pay the high price demanded for the land. The Council were again approached, and correspondence was reopened with the owners. As a result of protracted negotiations the price was eventually substantially reduced. Even at this figure, however, after adding the necessary overhead and management charges of a society, it was considered that the plots could not be let at a reasonable rent.

One side of the ground had a frontage to a lane leading from one of the main roads in the district. This lane was marked out under the town planning scheme for a 50-ft. roadway, and negotiations were under way for development of the estate by a local builder. As a result of a conference between the writer and the Borough Engineer, it was decided to offer the frontage of the proposed allotment ground to the builder at a reasonable figure. This was eventually agreed to with the result that  $3\frac{1}{2}$  acres were taken from the 28 acres, leaving the society with  $24\frac{1}{2}$  acres at a cost which would enable it to let plots at 1s. 3d. per rod. which was considered a reasonable figure. The society thereupon decided to register under the Industrial and Provident Societies Acts and thus be in a position to issue shares to its members and thereby provide the deposit on the purchase price. Shares of the nominal value of 5s. each were issued and all members were expected to take up a minimum of £2 worth of shares. As soon as the formalities of registration were completed, the Council were informed, and they in turn approached the Ministry of Health for consent to a loan to the society under the Small Holdings and Allotments Act, 1908. This was eventually sanctioned.

By a resolution of the Small Holdings and Allotments Committee of the Croydon Corporation the Corporation decided to advance 80 per cent. of the purchase price of the land, on mortgage to a properly constituted and registered society, the society to find the balance of 20 per cent. It was decided, therefore, by the executive of the society, to raise a share capital of £600 by means of 5s. shares to provide this 20 per cent. The shares were accordingly issued and when sufficient had been taken up to provide the 20 per cent., the money was paid over to the Croydon Corporation. Although negotiations for the

purchase of the land were commenced as far back as December, 1920, it was not until the end of December, 1922, that the society actually entered into possession. No member has so far been allowed to become a plotholder without first becoming a shareholder.

At the Annual General Meeting of the Society held on the 1st December, 1922, draft regulations were submitted and approved which laid down very clearly how the new ground was to be controlled by the society. Under these regulations—a copy of which was later supplied to each plotholder as he took over his plot—members were allowed to erect on their plots tool sheds of a uniform size, and these had to be erected as shown on the society's plan, on the right-hand back corner of each plot, 18 inches from any pathway. By this means, no two sheds would be back to back. It would be possible to wheel a barrow down the pathways between the plots, and the sheds when erected would give an appearance of uniformity which was essential for a well-ordered society.

Another regulation gives the General Secretary power to call on each member for at least one hour's work per month for the purpose of keeping the society's property in good order, and doing any other work necessary for the good of the society.

In order to be in a position to let plots at a rent which compares favourably with other allotments in the neighbourhood this regulation is absolutely essential. Where a society owns its own freehold it is quite impossible to consider paying for all labour required for general services, such as erection of fencing, cutting of trees, etc. In fact, instead of letting the plots at 12s. 6d. per 10-rod plot per year, the Local Authority in making their calculations, were unable in the first instance to see how they could be let at a lower rent than 18s. 6d. per plot if the Local Authority had to provide all the fencing and carry out other necessary works. It can only be done where the necessary organisation exists for meeting the difficulty and where "co-operation is the watchword" as in this society. In fact, without co-operation among all members of any allotment society, it is difficult to see how the best results can be obtained.

Before the plots were allocated all members were asked to state on a form (a) how much ground they required, (b) whether they were desirous of having their plot next to or near to a friend or friends, and (c) what form of assistance they would be willing to give to the General Secretary for the purpose of general requirements on the ground.



The allocation of the plots was in the hands of a sub-committee, who allotted plots on the basis that the further a man lived away from the ground, the nearer he should be to the entrance to the ground.

The sub-committee arranged at the same time to group members together as far as possible in accordance with their wishes as expressed in (b) on the form, and as a result practically all plotholders were satisfied with their decisions.

Obviously, in taking over ordinary pasture land for allotments—much the same as moving into an empty house—many things needed attention. The brook running through the centre of the ground and dividing the two fields had to be bridged in two places. For this purpose, the society purchased a quantity of railway sleepers and the necessary work was carried out by the plotholders. In addition, it was necessary to erect a cattle-proof fence, 810 ft. long, across the ground in order to cut off the wooded portion which had not been purchased. This work was also carried out by the members, at a cost of about  $\frac{1}{5}$ th of the estimate of the Local Authority, which estimate, of course, included the cost of labour—a very big item in these days.

The executive of the society decided that in order to meet their liabilities it would be necessary to charge 1s. 3d. per rod, *i.e.*, 12s. 6d. for a 10-rod plot. In addition to this, under the rules of the society, each member has to pay a yearly subscription of 1s. per member, irrespective of the amount of ground held by him.

It should be mentioned that the society have a very strong social side, for the beneficial results of which the executive are indebted to a committee, including women, who manage the whole of the catering and decorating part of the work. Whist drives, dances, concerts, etc., are held, and in estimating their balance sheet for this year and in order to be in a position to let plots at 1s. 3d. per rod, the executive relied on a good profit from this source. A profit also was looked for from the trading side of the society—seed potatoes, pea sticks, etc. In both cases, the expectations of the executive have been justified.

The society is in its first year on its new freehold ground, and, therefore, much still remains to be done. It would appear, however, from the financial state of the society at present that no trouble will be experienced this year—probably the heaviest year for expenses—in meeting its liabilities, including repayment of mortgage to the Council, and payment of interest at the rate of 5 per cent. to shareholders.

It should be emphasised that, in piloting through a scheme of this kind many difficulties have to be met. Executives of societies should, therefore, not be daunted by these, but go ahead, determined to overcome all obstacles at all costs. Ground should be decided on and application made to the Local Authority for assistance.

Owing to the fall in wages, the raising of the necessary £600 of share capital has not been an easy matter, and may not be so for any society. Patience is necessary; enthusiasm for the allotment movement is absolutely essential; tact should and must be shown in dealing with the many parties concerned in a venture of this kind; but if the subject is properly tackled, and tackled in a determined spirit, there seems no reason why every war allotment society in the kingdom should not acquire its own freehold and thereby help to make a big contribution to promoting the happiness and contentment of our citizens.

With building extending in many directions, all allotment societies should examine their position at once with a view to providing a permanent home for their members. No time should be lost. Every society should put the necessary machinery into operation at once, and by the co-operation of all members, attain the goal for which all allotment holders strive.

The writer will be happy to assist as far as lies in his power any allotment society which may desire further information. The registered office of the Society is "Rosehaven," Shirley Road, Croydon, Surrey.

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## MANURIAL TRIALS WITH OSIERS.

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THE present trials are the outcome of the treatment of osiers after spraying with nicotine soap for insect pests. They were intended primarily to select the best manures, or mixture of manures, from an economical and financial point of view, with a view to further trials. The results are published as there are no records at the present time dealing with manuring of osiers. The plots for the experiments were small since it was expected that only a few would be selected for further investigation on a larger scale. In order to make the details more readily avail-



able, the results are, however, calculated for an acre. The osiers in question are for the production of rods for the manufacture of large baskets (vegetable) and hampers. Under these circumstances quality is not so important as quantity, and the larger the quantity, the larger the return, other things being equal.

After the plantation was successfully treated in May, 1920, for an attack of *Galerucella lineola* and *Crepidodera aurata*, a light dressing ( $\frac{1}{2}$  cwt. per acre) of sulphate of ammonia was applied, to stimulate growth and tide the plants over the critical period when a second attack might occur. A part of the plantation was not treated and the marked difference between the returns from the treated and untreated areas made it evident that there were great possibilities for manurial treatment.

The soil in the plantation is a heavy loam with underlying clay and the area where the osiers are growing is generally flat, except in one place. As there is a small stream on the south side, it is an easy matter to flood the plantation during dry weather. Beyond the plantation, the ground rises sharply so that all water drains into the hollow and the stream. By this means the soil can always be kept moist even in the driest weather. The flooding is done on the water-meadow principle, and consists of a gentle soak and not a continual flush of water. By altering the direction of the water every row of plants gets the same treatment and the whole of the plantation is kept in an equal state of moisture. Beyond the light dressing of  $\frac{1}{2}$  cwt. of sulphate of ammonia the ground had received no manures previously.

In the spring of 1921, an area was selected for the trials. The ground had been weeded and cultivated, and the osiers were all of the same age and variety (Yellow osier). The area was marked into twenty plots,  $4 \times 4$  yards. On the 21st April, 1921, the manures, which had been separately weighed and packed for each plot, were applied, while the dung was weighed out at the neighbouring farm. With the exception of the dung and lime, the manures were applied as a light dressing in comparison with the usual quantities used for agricultural purposes. The rates of application, calculated per acre, were as follows:— Sulphate of Ammonia 1 cwt., Nitrate of Soda  $\frac{3}{4}$  cwt., Kainit 2 cwt., Basic Slag 4 cwt., Superphosphate 3 cwt., Lime 15 cwt., Dung 20 tons.

The quantities of manures used were largely tentative since there was no definite information available. Beyond the pre-

liminary success with a very light dressing of sulphate of ammonia it was uncertain how the others would affect the osiers, and as nitrate is regarded as having a bad effect on the quality of the rods, the nitrate of soda was kept very low while the sulphate of ammonia, proving successful, was repeated at twice the first application (of  $\frac{1}{2}$  cwt. per acre). The plots were kept small, firstly owing to the difficulty of getting a suitably large piece of ground, and secondly as it was expected that probably the six best plots would have little between them.

Early in June the plots were inspected. Growth had commenced and a general examination showed that some of the plots were already ahead of the others. The best plots were 18 and 19; next 17 and 20; then in order 14, 15 and 16; 13 and 7; 8; 9 and 10; 12; 11; 1; 2, 3 and 4; 5 and 6.

At the end of September an examination of the plots placed the order approximately as follows:—18 was best, then 19, followed by 17 and 20, after these 14, 15 and 16; 8; while the others showed little difference.

On the 9th of December the plots were cut and weighed separately. The result is given in Table I.

TABLE I.  
*Produce of Manured Plots.*

Plot.	Manures.							Weight of Production. lb.
1	Nitrate of Soda	...	...	...	...	...	...	12 $\frac{1}{2}$
2	Sulphate of Ammonia	...	...	...	...	...	...	14 $\frac{1}{2}$
3	Superphosphate	...	...	...	...	...	...	14
4	Basic Slag	...	...	...	...	...	...	13 $\frac{1}{2}$
5	Dung	...	...	...	...	...	...	14
6	Kainit and Basic Slag	...	...	...	...	...	...	13
7	Nitrate of Soda and Superphosphate	...	...	...	...	...	...	13
8	Sulphate of Ammonia and Superphosphate	...	...	...	...	...	...	15 $\frac{1}{2}$
9	No Manure	...	...	...	...	...	...	12
10	Lime	...	...	...	...	...	...	14
11	No Manure	...	...	...	...	...	...	11 $\frac{1}{2}$
12	Kainit and Superphosphate	...	...	...	...	...	...	13 $\frac{1}{2}$
13	Nitrate of Soda, Kainit and Superphosphate	...	...	...	...	...	...	14
14	Nitrate of Soda, Kainit and Lime	...	...	...	...	...	...	15
15	Nitrate of Soda and Basic Slag	...	...	...	...	...	...	16
16	Sulphate of Ammonia and Kainit	...	...	...	...	...	...	16
17	Nitrate of Soda, Kainit and Basic Slag	...	...	...	...	...	...	19
18	Sulphate of Ammonia, Kainit and Superphosphate	...	...	...	...	...	...	23
19	Nitrate of Soda, Kainit and Dung	...	...	...	...	...	...	20
20	Nitrate of Soda and Kainit	...	...	...	...	...	...	18
X	Sulphate of Ammonia	...	...	...	...	...	...	17



The general progress of the osiers during growth shows that the best plots were markedly superior to the others at a very early stage in their growth. Hence anything which stimulates early growth will probably give the best results. The weighings gave curious results, Plots 2, 7, and to a slight extent 13 and 14, were far below expectation, while the osiers flanking these plots were poor, particularly near 1 and 2. To test this a representative area of 4 × 4 yards was selected from the bulk of the osier crop which was manured with sulphate of ammonia at the rate of 1 cwt. per acre and cut. The result is given in Plot X. Soil samples were carefully extracted and it was found that clay appeared about 6 or 7 inches below the surface in a line cutting obliquely across Plots 2, 7, part of 13 and 14; for the rest of the area the clay was 9-12 inches below the surface. The clay was not a solid mass but occurred mixed with the soil and increased at lower depths.

The increase on the manured plots was in two directions (1) length and size, and (2) number. The rods were good and clean stemmed (no side branches) and in the case of Plot 18 the height was 6-7 feet. The poorer plots had fewer and smaller rods, the lowest being only about 3-4 feet high. The results are very much what one would expect, the complete manures giving the highest yields. The next point of interest is that generally superphosphate is better than basic slag. Nitrate of soda did not give quite such satisfactory results as sulphate of ammonia, even allowing for the lighter application. The explanation of this is rather difficult, it may be that the excessive moisture favours bacteria which utilise or destroy the nitrate or that it passes right down through the soil before the roots of the young rods can obtain any benefit from it.

Turning next to the economical or financial side of the trials, the cost of the manures was calculated according to the prices at the time of application. The cost of applying single manures is put at 9d. per acre and for the mixing and application of mixed manures at 1s. per acre. The cost of transport is 1½d. per bolt or bundle (of an average weight of 38 lb.) to the nearest market. The sale price per bolt is reckoned at 3s. although at times it may be considerably higher. (*See Table II.*)

The method of marketing rods varies considerably. In the present case they are sold by the bolt—a bundle measuring 1½ feet across the base. This made financial calculations very difficult as the plots were compared by weight, while the bolt is practically a measure weight. In the circumstances a

very exhaustive series of weights was made, and it was found that since there were much fewer of the larger rods to a bolt than the smaller, any variation due to the individual bolt disappeared when the total was taken in bulk. Accordingly 38 lb. as the weight of the average bolt was taken as the standard. The actual marketing of the bolts of big rods and little rods showed that what at first seemed to be the introduction of a very grave error was remarkably accurate in practice and its application to the crop in general justified.

TABLE II.

*Financial Results of Manuring, per acre.*

Total value of increase in crop per acre.			Total cost of production and transport of increase per acre.			Profit or loss per acre on increase.		
	£	s. d.		£	s. d.		£	s. d.
1	...	0 12 0	...	0 12 6	—		0 0 6	
2	...	3 0 0	...	0 18 0	+		2 2 0	
3	...	2 8 0	...	0 16 3	+		1 11 9	
4	...	1 16 0	...	0 16 3	+		0 19 9	
5	...	2 8 0	...	3 2 9	—		0 14 9	
6	...	1 4 0	...	1 2 9	+		0 1 3	
7	...	1 4 0	...	1 6 9	—		0 2 9	
8	...	4 4 0	...	1 12 9	+		2 11 3	
9	...	—	...	—			—	
10	...	2 8 0	...	2 0 6	+		0 7 6	
11	...	—	...	—			—	
12	...	1 16 0	...	1 2 9	+		0 13 3	
13	...	2 8 0	...	1 14 6	+		0 13 6	
14	...	3 12 0	...	2 19 6	+		0 12 6	
15	...	4 16 0	...	1 10 3	+		3 5 9	
16	...	4 16 0	...	1 6 6	+		3 9 6	
17	...	8 6 6	...	1 19 11	+		6 6 7	
18	...	13 2 6	...	2 6 11	+		10 15 7	
19	...	9 10 6	...	4 6 9	+		5 3 9	
20	...	7 2 6	...	1 4 11	+		5 17 7	
X	..	6 0 0	...	1 0 6	+		4 19 6	

No. 9 12 lb.—3,624 lb. per acre at 3s. lb., approx. £14 5s. per acre. Cost of production, &c., not known.

During the year 1922, the trials were much more limited, and two types were selected for quantity tests—sulphate of ammonia for 3-year-old osiers and the manures of Plot 18 for 1-year-old osiers on a higher and consequently a drier area. For the year-old osiers, three areas each of 28.5 sq. yards were selected and the manures applied as under:—

	<i>Superphosphate</i>				<i>Kainit</i>				<i>Sulphate of Ammonia</i>		
No. 1	...	4	cwt.	...	3	cwt.	...		2	cwt.	per acre
„ 2	...	3	„	...	2	„	...		1	„	„
„ 3	...	1½	„	...	1	„	...		1	„	„

*No. 2 was at the same rate as Plot 18 of 1921.*



For the 3-year-old osiers, the plots were each of 225 sq. yards. The sulphate of ammonia was applied as follows, per acre:—No. 4, 2 cwt.; No. 5, 1 cwt.; No. 6,  $\frac{3}{4}$  cwt.

The results on the drier areas were very poor and the yields less than the unmanured plots of 1921. The highest was 3,396 lb. per acre, while the unmanured Plot 9 (of 1921) gave 3,624 lb. per acre.

The yields per plot were:—No. 1, 3,396 lb. per acre; No. 2, 3,227 lb. per acre; and No. 3, 3,396 lb. per acre (the same as No. 1).

The obvious conclusion to be drawn from these is that unless there is a plentiful supply of water, manures will produce no increase. Even the superphosphate failed to stimulate the roots and enable them to grow down and obtain water from a lower level. The failure of the plots on the higher ground where the increased and decreased application of complete manures was carried out, prevented any further progress in that direction.

As regards the 3-year-old osiers, there was a steady increase with each additional application of sulphate of ammonia:—No. 4, 15,440 lb. per acre; No. 5, 14,830 lb. per acre; No. 6, 12,710 lb. per acre.

The untreated area gave 11,800 lb. per acre. The increase on No. 4 is, therefore, 3,640 lb., No. 5, 3,030 lb. and No. 6, 910 lb. The large increase from Plot 6 to Plot 5 is probably due to a spell of wet weather in the early stage of the trials when weeds grew vigorously and doubtless obtained a large share of the manure. The higher applications of Plots 5 and 4 would not show this loss to the same extent.

<i>Plot</i>		<i>Value of Increase</i>		<i>Cost of Manuring</i>		<i>Profit</i>
4	...	£14 7 0	...	£1 15 3	...	£12 11 9
5	...	£11 19 0	...	£1 2 3	...	£10 16 9
6	...	£3 2 0	...	£0 12 0	...	£2 10 0

The results of the trials, although by no means conclusive, show that manuring osiers will pay, at least on certain types of soil. Although it may not be so satisfactory in the case of rods used for fine and delicate basket work, there seems no reason why it should not be successful, provided too much nitrogen is not supplied. Experiments alone will decide this point. In spite of the small size of the plots, and the errors that will arise in calculating per acre on such a small scale, and also the none too satisfactory calculation of bolts by weight, there is still such a margin that the most generous calculation

for errors will not affect to any degree the financial result. The actual returns from the whole area after manuring with sulphate of ammonia show a very marked increase, particularly on the financial side, which is after all the test for the grower.

Unfortunately the area which has been under investigation is not satisfactory for large scale trials, and the difficulty of controlling experimental areas so far from the College and the difficulty of absence from departmental duties makes any further work impossible. The results are, therefore, published as they stand in the hope that it may help others with more time and better opportunities for carrying out such work.

In conclusion the writer wishes to thank A. Body, Esq., of Plymouth, without whose generous help and permission these trials could not have been carried out, and his colleagues on the staff of Seale-Hayne College, for assistance.

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## LIVER ROT OF SHEEP.

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AN account of the outbreak of liver rot in North Wales in 1920-21, with a report on some spraying experiments carried out by the author against the host snail was published in this *Journal* for May, 1922, p. 154. Further observations and a continuation of the experiments are described below.

The violent outbreak of this disease in 1920-21 died down during the hot dry summer of the latter year, the host snails being reduced from extreme abundance to probably less than normal numbers. Numerous drainage and spraying operations by farmers and others further assisted in this process. The unusually cool, damp summer of 1922 resulted in some local increases, however, and on some of the wetter lands infected livers were again reported. In most cases precautionary measures were taken and no severe losses have been reported even during the wet winter of 1922-23: the only cases noted were an odd one here and there, far below the normal of average years before the epidemic.

Accounts of the epidemic and experiments undertaken in connection with it and their results will be found in the following sources :- (1) This *Journal* (see above); (2) Report of the Department of Agriculture of the University College of North Wales,



January, 1922; (3) Advisory Leaflet No. 1, Department of Agriculture, University College of North Wales, September, 1922. In these publications dusting and spraying experiments are described. copper sulphate in powders and solutions being used with good results against the snails which act as intermediate host for the parasite causing the disease (*Fasciola hepatica*).

Since these articles were written there has been a good deal of discussion and observation with regard to the snails acting as intermediate host with the following important results. There are present in North Wales three distinct species of freshwater snails of the genus *Limnaea*, these being (a) *L. truncatula*, a small species, very abundant, and the usual carrier and intermediate host of the flat worm causing liver rot; (b) *L. peregra* (or *pereger*), a larger and stouter species, equally common, but generally found on softer mud than the former; and (c) *L. palustris*, a species as large as (or larger than) *peregra*, but with a longer, narrower, darker and more pointed shell. Further, *palustris* is a much less widely distributed species than the other two, although locally abundant, as on parts of the Malldraeth Marsh (Anglesey), the Abergele district and elsewhere. During work on these snails in Mid and North Wales the writer had several times obtained from *L. peregra* young (larval) flukes indistinguishable from those causing liver rot, and so common in *L. truncatula*. Dr. Monica Taylor (in recent letters to "Nature") believes that this snail (*peregra*) is the usual carrier in some parts of Scotland, where liver rot occurs and *L. truncatula* is scarce or absent. Such being the case it becomes necessary for Welsh farmers and others to regard this second and very common species as probably dangerous, and to destroy it whenever possible. Fortunately the means advocated for the one are equally effective for the other. No incriminating evidence seems as yet to have been obtained against *L. palustris*.

**Experiments with Sulphate of Ammonia and Copper Sulphate.**—In the autumn of 1922 Professor R. T. Leiper drew the writer's attention to the suggestive results obtained in some Laboratory experiments carried out in the Department of Helminthology in the London School of Tropical Medicine, in which ammonium sulphate was found to kill *L. truncatula* and its eggs. Further, Dr. Khalil found that solutions of 1/1000 of the crude fertiliser killed the egg masses of *L. peregra* and *Planorbis corneus* in 6 hours.\* It was therefore resolved to

\* *Journ. Tropical Medicine and Hygiene*, March, 1922.

carry out a series of field experiments against *Limnaea* in North Wales, using sulphate of ammonia. A very suitable situation was found at Tyddyn Mawr, Holland Arms, Anglesey, and thanks are due to the owner and occupier, Mr. H. O. Williams, and his son, for their kind assistance during these experiments. Sulphate of ammonia, if successful, would have had several marked advantages (a) as an egg killer, (b) as being non-poisonous, (c) as having a manurial value. So far, however, it has not proved an efficient snail killer in field practice. The experiments may be summarised as follows:—

(A) The application of 30 lb. of commercial sulphate of ammonia, by hand, to 500 square yards of grass land, flooded from a damaged drain, and heavily populated with *L. truncatula*, 12th December, 1922. This dressing equalled 2.6 cwt. per acre at a cost of about £2 per acre. The amount of water present was estimated at an inch deep, giving a solution of 1/780 or 0.13 per cent. This, however, did not kill the snails, which remained unaffected. There was a slight flow of water on this area at the time of application. Laboratory experiments had indicated 1/1000 as effective against eggs.

(B) A ditch, about a foot deep, with a gentle flow down the centre between clayey banks, containing numerous large *L. peregra*, many *L. palustris*, and a few *L. truncatula*. This was treated (12th December, 1922) with a dust composed of 1 part of dry neutral sulphate of ammonia and 2 parts of kaolin (china clay). This latter was used as a spreader and "tracer." Application was by a hand bellows. A hundred square yards were treated at an approximate cost of £1 9s. per acre. Twenty-four hours later the death rate was found to be 70 per cent.—that in a ditch chiefly inhabited by *L. peregra*.

(C) A similar ditch, but wider and more stagnant, with no obvious flow. *L. peregra* was present but not abundant. Fifty square yards were dusted with equal parts of neutral sulphate of ammonia and china clay (12th December, 1922). All the snails subsequently found and examined were dead, but the numbers were not great.

(D) 100 square yards of damp or slightly flooded grass land (same situation as A) were dusted on 8th March, 1923, with equal parts of dry neutral sulphate of ammonia and china clay at the rate of 1 cwt. of each per acre. *L. truncatula* was very abundant. The results are discussed below, with (E).

(E) 60 square yards (alongside D) were dusted with equal parts of fine powdered copper sulphate and china clay, also at the



rate of 1 cwt. of each per acre. *L. truncatula* was very abundant. 300 snails were collected 24 hours later and placed in clean water in the laboratory, and showed the following results:—

- (a) 50 snails dusted with sulphate of ammonia, on damp mud : 10 per cent. dead.
- (b) 50 snails dusted with sulphate of ammonia, in shallow water : 5 per cent. dead.
- (c) 100 snails dusted with sulphate of ammonia, from mud and shallow pools : 10 per cent. dead.
- (d) 50 snails dusted with copper sulphate, on damp mud : 100 per cent. dead.
- (e) 50 snails dusted with copper sulphate, in shallow water : 100 per cent. dead.

The foregoing experiments would seem to show that sulphate of ammonia is of little value under field conditions in North Wales against *L. truncatula*, but has greater killing power for *L. peregra*. On the other hand, copper sulphate was as successful as in the earlier experiments, and is therefore still to be recommended, with the usual precautions as to avoidance of stocking treated ground until after heavy rain, and the exercise of care in treating flowing streams that may be used for watering stock, or may affect fishing waters, etc. An interesting case occurred in which a large and valuable flock of sheep was discovered to be grazing fields parts of which were swarming with *L. truncatula*, and nevertheless remained healthy. No larval flukes could be obtained from several large batches of these snails which were apparently not affected and were therefore, for the time being, harmless. This flock had suffered severely during the epidemic.

Several ditches, etc., cleared of snails by the use of bluestone dusts 18 to 24 months previously were re-examined and found to remain free of snails, but one flowing stream, in Anglesey, had been repopulated throughout its length with *L. peregra*, by migration from side streamlets.

In one instance several large damp grass fields swarming with *L. truncatula* (and the cause of very heavy losses in 1920-21) were ploughed and put under oats. This treatment was successful: only two specimens were detected in a damp place between furrows during subsequent examinations. These fields were again seeded down with the oats, and the resultant grass fields were practically clear of snails when examined, thus indicating a method of treatment of value on such land.

The value of ducks was also further demonstrated by the examination of a shallow stream running through the grazing

lands of a series of farms, many of which were affected during the epidemic. Where the stream passed near the homesteads and ducks were kept, no snails could be discovered, but away from the buildings, where the ducks did not range, *L. truncatula* and *L. peregra* occurred, in some cases in thousands.

\* \* \* \* \*

## "SLEEPY DISEASE" OF THE TOMATO.

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THE term "Sleepy Disease" as used by the average nurseryman in this country covers a number of separate diseases, the most important of which is *Verticillium* wilt. Of the other diseases included under this general title may be mentioned *Fusarium* wilt, and root rot caused by *Vermicularia varians*, Ducomet. Plants attacked by different species of *Fusarium* following wireworm injury also come under the same category.

*Verticillium* wilt usually appears about the middle of April and increases in severity up to the second and third week in May. Fresh cases are rarely found during the second half of June, July and August, but the disease frequently reappears in September and the attacked plants die prematurely. *Fusarium* wilt requires a high temperature and occurs only at the hottest time of the year. Death by *Vermicularia varians* usually takes place in August or September, while cases of root rot may be found continuously through the season. As *Verticillium* wilt is the most important disease of this class, it forms the subject of the remainder of the article.\*

Plants attacked by *Verticillium albo-atrum* are usually stunted in appearance, and the youngest internodes are badly developed. Under conditions of light and temperature favourable to the fungus the disease symptoms appear quite suddenly and the plant wilts while still green. During the night the plants may recover their turgidity, but wilt again as the morning advances. The leaves wither from the base of the plant upwards, adventitious roots emerge from the stem and the plant dies. Under conditions less favourable to the fungus, the process of death is much slower: yellow blotches appear on individual leaflets on the lower leaves and these leaflets wither. This process continues slowly up to the top of the plant, when death occurs. When the plant is dead the fungus within it grows out to the air.

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\* A full account of this disease has been published in the "Annals of Applied Biology," Part 2, Vol. 9, 1922, to which further reference should be made.



and produces a white spore-bearing layer of hyphæ which covers the surface of the stem near to the ground. A great many spores are produced and serve to disseminate the disease.

On cutting open a diseased plant in a longitudinal direction, it will be seen that the wood is distinctly brown in colour as compared with that of a healthy plant. This browning of the wood is a common phenomenon connected with the presence of a fungus, and may be seen also in plants suffering from *Fusarium* wilt; *Vermicularia* root rot, etc. *Verticillium* wilt, however, may be readily distinguished from these other diseases, for in this disease, the browning of the wood generally extends to within a few inches of the top of the plant, while in the other diseases mentioned it is rarely found higher than a foot above ground.

The causal organism, *Verticillium albo-atrum*, may be isolated readily by transferring a small piece of infected wood to a tube of sterile medium. Inoculations performed by pricking a small piece of hyphæ from a pure culture into the stem of a healthy plant invariably cause wilt in from two to six weeks according to the temperature conditions to which the plant is exposed. While wounds are an assistance to infection, it has been proved by carefully controlled experiments that they are not essential.

The fungus possesses a wide host range and during our investigation has been isolated from wilted potatoes, snapdragons, cucumbers, pepper plants, sweet peas and cotton plants. The strain isolated from a tomato plant readily attacks the above plants, also the egg plant, sycamore, and elm.

**The Relation between Temperature and the Incidence of the Disease.**—Monthly inoculation experiments yielded results which seemed to indicate that a close relation existed between environmental conditions, especially temperature, and successful infection. Further investigation was deemed necessary.

As a series of glasshouses, where different temperatures could be constantly maintained, was not available, inoculated plants (hypocotyl stab) were placed in different positions in the experimental houses, corridors, etc., under different average temperature conditions. Twelve plants were placed in each position, and the average temperatures were calculated from readings taken twice daily from maximum and minimum thermometers placed beside the plants. The final observations, shown in the following tables, were taken twenty-one days after inoculation, and where figures are given they represent the average obtained from twelve plants.

TABLE I.

*Progress of Disease in different Temperatures.*

	Frame	Corridor	Tomato House	Cucumber House
Average temp. F. ... ..	54·6°	62·4°	70·3°	77·2°
Absolute min. F. ... ..	42°	52°	54°	69°
Absolute max. F. ... ..	69°	73°	82°	92°
Date of inoculation ... ..	14/4/20	14/4/20	14/4/20	14/4/20
No. of days from inoculation	21	21	21	21
Ratio of wilted to total leaves	0/10	6/12	8/12	0/12
Height of discoloured wood above stab ... ..	15 cms.	26 cms.	28 cms.	9 cms.
No. of days from inoculation until complete wilt ... ..	49	28	28	No wilt after 80 days

While the results obtained are open to criticism because of the wide range of temperature to which the plants were submitted in any one position, certain facts emerge which have been fully confirmed by observations on commercial nurseries. Chief among these are the beneficial effects which shade and temperatures above 75° F. have upon plants suffering from wilt. Table I shows that average temperatures of 63° F. and 70° F. are favourable to the rapid progress of the disease, that of 54° F. is unfavourable, while that of 77° F. practically inhibits it. It will be seen that the organism has travelled most rapidly up the stem, as indicated by the browning of the wood, at 63° F. and 70° F., and at these temperatures also complete wilt occurred most rapidly. The results shown in Table II, while confirming the temperature relations shown in the preceding table, also show the beneficial effect of shade. While

TABLE II.

	Frame	Tomato House		Cucumber House	
		Unshaded	Shaded	Unshaded	Shaded
Date of inoculation ... ..	14/4/20	14/4/20	14/4/20	14/4/20	14/4/20
No. of days from inoculation	21	21	21	21	21
Average temperature ... ..	62·4° F.	71·5° F.	68·9° F.	79·3° F.	77·1° F.
Ratio of wilted leaves to total leaves ... ..	6/10	3/10	0/10	0/10	0/10

plants in the unshaded house readily wilted, those in the shaded house, although the temperature was favourable to the disease, did not wilt.

General observations have also shown that temperatures between 60° F. and 75° F. with an optimum of 70-73° F. are favourable to the rapid progress of *Verticillium* wilt, which below 60° F. and above 75° F. is exceedingly slow, while suitable shading counteracts the effect of low temperatures.

A series of experiments were next arranged in which wilted plants were transferred to high temperatures to ascertain if they



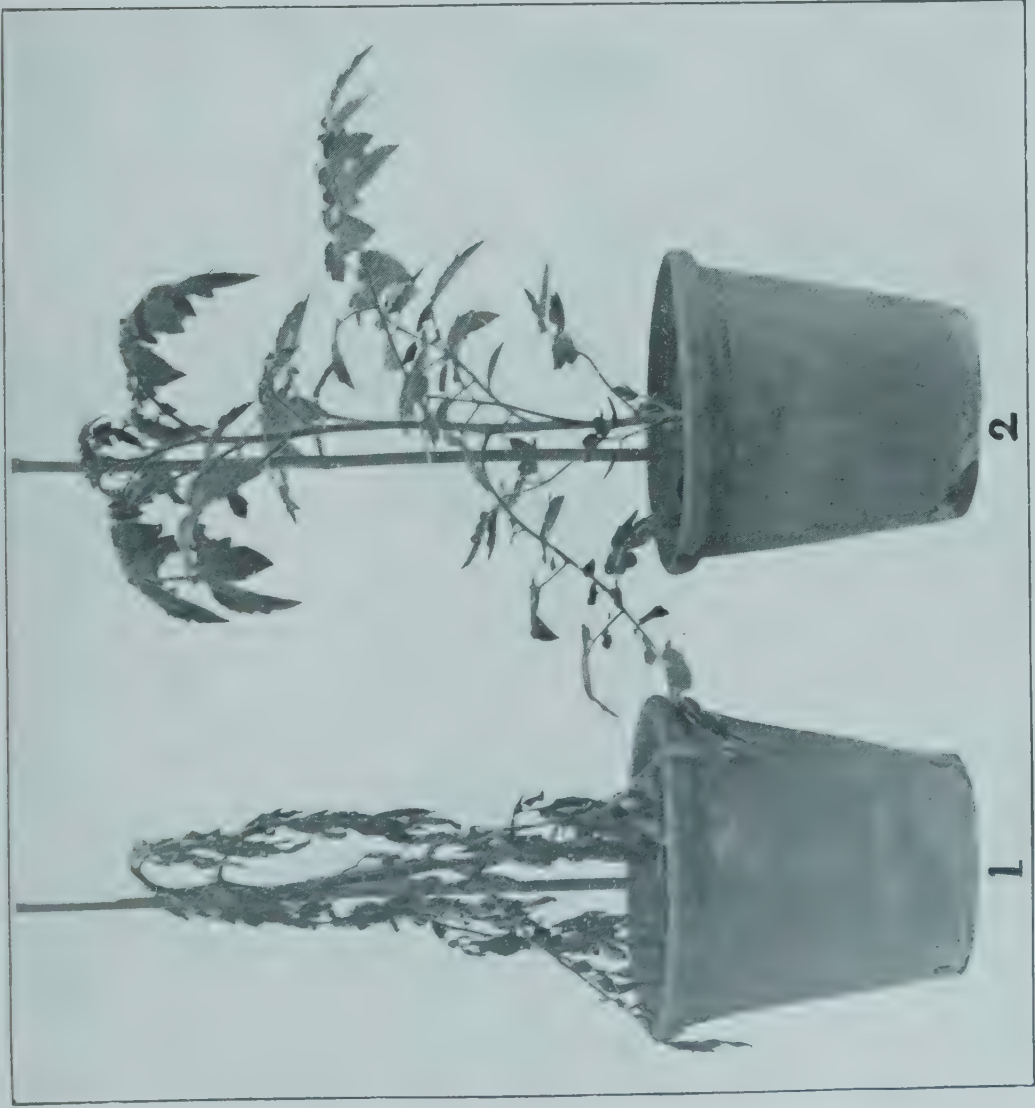


FIG. 1. (1) Wilted plant 6 weeks after inoculation with *Verticillium albo-atrum*.  
(2) Control plant.

(Figs. 1 and 2 reproduced by kind permission of  
The Association of Economic Biologists.)



FIG. 2.—Showing the wilted plant  
after being submitted to shade and  
an average temperature of 25° C.  
(77° F.). The wilted leaves have  
fallen, but the plant has recovered  
and made good growth in the  
open air.





would recover, and if such a recovery would continue when they were returned to lower temperatures. The results given in Table III indicate that wilted plants recover when the average temperature is raised to 77° F. and they are shaded. When such a temperature is operative for a short time the effect is not a lasting one, for the plants rapidly wilt again when the temperature is lowered. Longer exposures to the high temperature produce a more lasting result, for after 75 days at 77° F. the plants remained turgid for 30 days at a temperature favourable to wilt. Table IV compares the percentage of wilted plants which recover when transferred to a shaded house at an average temperature of 77° F., with that of similar plants transferred to an unshaded house at the same average temperature.

TABLE III.

*Effect of High Temperature and Shade on Wilted Plants.*

No. of wilted plants	Length of time in shaded cucumber house. Average temp. 77° F.	Effect of high temperature	Length of time after returning to average temp. 70° F. before plants wilted again
12 ...	1 day	... Recovered	... 15 hours
12 ...	2 days	... "	... 15 "
12 ...	7 "	... "	... 2 days
12 ...	14 "	... "	... 3 "
12 ...	30 "	... "	... 16 "
12 ...	75 "	... "	... 30 "

TABLE IV.

*Effect of High Temperature with and without Shade on Wilted Plants.*

No. of wilted plants	No. of days wilt has been visible prior to experiment	Per cent. recovered in shaded cucumber house. Average temp. 77° F.	Per cent. recovered in unshaded cucumber house. Average temp. 77° F.
20 ...	2	... 100	... 100
20 ...	7	... 100	... 100
20 ...	14	... 100	... 100
20 ...	21	... 100	... 90
20 ...	30	... 100	... 80

Plants in different stages of wilt were used, from a series where the wilt was just commencing to show to a series in an advanced stage after 30 days' wilting. All the plants recovered in the shaded house, but only a percentage recovered in that which was not shaded. The plants which did not recover in the unshaded house, being badly wilted ones, were probably desiccated before they had a chance to recover.

These observations appear to justify the conclusion that temperature is a most important factor, while shading is valuable because it assists the plant by reducing transpiration. The

minimum, optimum and maximum temperatures for growth in pure culture of the strains of *Verticillium albo-atrum* utilised for the inoculation were 40° F., 74° F. and 86° F., respectively. It will be seen, therefore, that the optimum temperature for infection coincides approximately with the optimum temperature for growth in pure culture. *Verticillium* wilt is distinctly a disease of low temperatures and is most severe in spring and autumn.

*Shade*.—Shade, as we have seen, has a beneficial effect upon the resistance of the host to the disease. Probably this is due to retarded transpiration and consequently to the decreased rate of conduction of the water in the vessels, so that the toxic products excreted by the fungus are not carried up the plant in such large amounts.

*Soil Factors*.—Experiments carried out with soils of different types show that *Verticillium* wilt is not restricted to any particular type. Generally speaking, plants on soils which contain a large amount of humus yield a greater amount of disease than those growing on soils of a poorer nature. Clay soils, in virtue of their greater water-holding capacity, are cooler than sandy soils, and plants grown upon them are more prone to wilt than those grown on the latter.

**Control**.—Further work is in progress to determine a suitable chemical agent which will sterilise the soil and effectively cleanse it of the wilt-producing organisms. Investigations are also being carried out on the efficacy of manurial treatment in rendering the plants resistant to fungal attack, but it is too early to suggest any treatment.

*Cultural Methods*.—Cultural methods for the control of the wilt have been devised, and have been tested with promising results.

It is commonly held by pathologists that plants exhibiting hard growth are more resistant to disease than the more succulent types, but observations on wilt disease show in this case the reverse to be true, the harder growing varieties succumbing more readily than the more succulent ones. The only variety, Manx Marvel, which so far has proved highly resistant to *Verticillium* shows a distinctly free growth with thick stems and large leaves.

It has been specially noted that plants, starved in the early stages, or having suffered from a severe check are highly susceptible. Also it has been mentioned previously that the average temperature of the air and soil are limiting factors in



the incidence of the disease. The disease is first seen in spring, when the temperature is low, but with the coming of the higher summer temperature the wilted plants recover, and the percentage mortality of the plants infected in the spring depends upon the length of time the cold weather lasts.

The incubation period for the disease varies from eight to twenty days under favourable conditions and complete wilt and death occur in from six to eight weeks after the first symptoms appear, if conditions are favourable for the fungus. Should the temperature be sufficiently raised before the plant dies, it will recover and produce a satisfactory crop during such time as the temperature remains high. Once the temperature drops in the autumn, wilt reappears, and the plant dies prematurely. Early summer temperatures, therefore, enable the plant to resist the fungus. It will at once be evident that good results may be obtained by artificially shortening the period of low temperature, and in glasshouses this may be done by increasing the boiler heat, and closing down the houses in the middle of the day.

The following cultural methods for controlling the disease have given satisfactory results. As soon as the wilt appears and it is proved that *Verticillium albo-atrum* is the cause, the average temperature of the houses should be raised above 77° F. by suitably increasing the boiler heat, regulating the ventilation, and closing down the houses for from two to four hours in the middle of the day. A thin coat of whitewash on the glass makes the conditions still more favourable for the plants. As little water as possible should be given to the roots, as heavy watering merely aggravates the wilting, but a light overhead damping helps the wilted plants to recover. The plants should be encouraged to make fresh roots by heaping up the soil round the base of the stem.

In one case sixty-eight per cent. of the plants in a nursery were showing symptoms of wilt disease before the above methods were enforced, but a fortnight after only ten per cent. remained wilted. In view of the fact that the low spring temperatures are favourable to infection by *Verticillium*, some advantage might be gained by planting later than normally, so that the higher summer temperatures may arrive by the time the plants have reached a suitable stage for infection.

Examination of the effect of kind of soil upon the incidence of the disease has shown that soils rich in humus yield a higher percentage of diseased plants than those of a poorer nature.

Results obtained on the experimental plots at this station confirm this—the greatest percentage of *Verticillium* wilt occurs on the plots receiving complete artificials with large amounts of dung.

*The Elimination of Sources of Infection.*—Too much stress cannot be laid on the fact that it is useless to sterilise the soil if centres of infection are allowed to exist in the neighbourhood of the nursery.

Certain workers have pointed out that *F. lycopersici* will develop much more rapidly in sterilised soil than in ordinary unsterilised soil. Presumably this is due to the fact that sterilisation eliminates a large number of bacteria and fungi organisms. We have found the same to be true for *Verticillium albo-atrum*, for plants growing in incompletely sterilised soil or re-inoculated sterilised soil have a higher percentage of disease than those in unsterilised soil. This is accentuated if the soil be exceedingly rich in humus, as is the case with sterilised cucumber soil, which is frequently used for tomato growing. The determination and elimination of infection centres thus become of vital importance. The fungal outgrowths at the base of dead diseased plants produce innumerable spores which become widely disseminated. These in themselves will not carry the fungus over the period of winter, being destroyed by drying, but they readily germinate, and feeding on decaying plant material, produce carbonised hyphæ and microsclerotia, which are able to withstand winter conditions. Close examination has been made of small pieces of plant remains which have been unearthed from nursery soils, after the crop has been removed, and numerous tomato pests, including *Verticillium albo-atrum*, have been found upon them. Thus it is important to remove completely all dead plants before the fungal outgrowths appear, and in the process of cleaning up the nursery when the crop is finished, to remove carefully as much as possible of the dead plant-remains. Careful attention to these matters will prevent the rapid spread of the disease. The best way to remove the crop, when completed, is to sever each plant about three inches from the ground before attempting to remove the roots. If the surface is quite clean before the roots are removed there is less chance of incorporating diseased material in the soil and the roots may then be carefully taken up, leaving behind only the very fine rootlets.

Another source of infection which becomes more and more evident is the contamination carried in “ strikes ” or baskets,



and a considerable number of cases have been noted, where infection with various diseases came from these articles. Such baskets may be so mixed at the market, that when they are returned, those from one nursery are sent to another and so disease is spread. Baskets should not be taken near to the growing plants for fear of introducing some new trouble, and during the winter months all baskets should be sterilised in readiness for the coming season. The importation of young plants from other nurseries is a procedure to be deprecated, for it is a fruitful means of disease transmission. Contaminated water from surface wells is a constant source of infection with many diseases, and care should be taken to use a pure water supply. Potatoes and antirrhinums should not be grown in the vicinity of tomatoes as they are susceptible to *Verticillium*.

*Disease Resistant Varieties.*—The production of resistant varieties has offered the most satisfactory and in some cases the only effective means of controlling a number of plant diseases. An attempt is now being made to raise a *Verticillium*-resistant tomato, the necessity being borne in mind of producing a plant which will yield a good crop of well-formed fruit.

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## THE PRINCIPLES OF POULTRY FEEDING.

### II.

**Value in Comparison with other Feeding Stuffs.**—The value of any feeding stuff can be estimated with accuracy only after taking into consideration many factors, and poultry-keepers desiring to familiarise themselves with these factors should study "*Rations for Live Stock*," by Professor T. B. Wood, of Cambridge University.\*

Briefly, it may be said here that whilst experimental work in connection with cattle, horses, sheep and pigs has advanced so far that the quantities of digestible proteid and starch equivalent required daily by idle horses, horses on heavy work, store cattle, cows giving different quantities of milk, etc., are known, no similar information regarding poultry is available.

In the meantime, probably the best method for the poultry-keeper who wishes to estimate the value of any feeding stuff

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\* Miscellaneous Publication No. 32, to be obtained from the Ministry, 10, Whitehall Place, S.W.1. Price 6d. net, post free.

for his poultry will be to examine the digestible nutrients shown in the table, to take into consideration the amount of fibre and ash or mineral matter which the feeding stuff contains, and then to calculate the proportion between the proteids on the one hand and the carbo-hydrates and fats on the other hand which the total ration contains. This proportion is known as the nutritive ratio and is shown in the table for each individual feeding stuff. For example, in the case of maize and maize meal, it will be seen that for every part of proteids there are 11 parts of carbo-hydrates and fat. This ratio is calculated by multiplying the percentage of oil by 2.5, adding the percentage of digestible carbo-hydrates and dividing the result by the percentage of digestible proteid. For example, in the case of maize :—

$$\frac{(\text{Digestible oil} \times 2.5, + \text{Soluble Carbo-hydrates.})}{\text{Digestible Proteid.}} \\ \frac{(3.9 \times 2.5) + 65.7}{7.1} = \frac{75.45}{7.1} = 10.62 = \text{approx. } 11,$$

therefore nutritive ratio is as 1 is to 11.

This ration is found in practice to be too wide to form the whole ration for laying hens; the proteid content is too low and the fat-producing constituents are too high. The maize therefore is given in conjunction with other feeding stuffs richer in proteid and of a less fattening nature. It is necessary therefore to calculate the nutritive ratio of the total mixture, and the simplest way of making this calculation is to ascertain the total digestible proteid and the total digestible carbo-hydrates and fat in the mixture and then work out the ratio as in the case of a single feeding stuff. Take for example the following ration :—

2 lb. of bran, 4 lb. middlings, 1 lb. of Sussex ground oats, 1 lb. of maize gluten feed, 1 lb. of clover meal, 1 lb. of fish meal.

Assuming that the grain feed used with this ration is

2 lb. maize, 1 lb. wheat, 1 lb. oats,

and that the poultry receive during the day equal weights of the grain and mash rations; it is of little value calculating the nutritive ratio of the mash alone, and therefore the total food given through the day must be considered. Now on referring to the table, it is seen that bran contains 10.6 per cent. digestible proteid and therefore 2 lb. of bran will contain 0.212 lb. of this constituent. The table also shows that bran contains 5 parts carbo-hydrates and fats to every part of proteid and therefore 2 lb. of bran will contain 1.06 lb. digestible



carbo-hydrates and fats. Following this method, the following calculation can be made:—

					<i>Digestible Proteid.</i>		<i>Digestible Carbo-Hydrates and Fats.</i>
2 lb. bran	...	..	...	...	0·212	× 5	= 1·060
4 „ middlings (coarse)	...		...	...	0·552	× 4	= 2·208
1 „ Sussex ground oats	...		...	...	0·080	× 7	= 0·560
1 „ alfafa (lucerne)	...		...	...	0·032	× 2	= 0·064
1 „ maize gluten feed	...		...	...	0·200	× 3	= 0·600
1 „ fish meal	...		...	...	0·727	× 0	= 0·000
2 „ maize (kibbled)	...		...	...	0·142	× 11	= 1·562
1 „ wheat	...		...	...	0·102	× 7	= 0·714
1 „ oats	...		...	...	0·080	× 7	= 0·560
Total...					2·127		7·328

therefore nutritive ratio of total day's ration

= 1 :  $\frac{7·328}{2·127}$  = 1 : 3·4.

This ration for mash and grain is one which is often used, but it has a narrow or high nutritive ratio and it is doubtful whether such a high quantity of proteid in the daily feed is either necessary or advisable.

The following ration gives a wider nutritive ratio and is of a less forcing nature, but would probably produce equally as many eggs as the first ration with less risk to the health of the birds. A ration with a narrower nutritive ratio than 1 : 4 is probably unnecessary for laying poultry and there is some evidence to show that an even wider ratio than 1 : 4 $\frac{1}{4}$ , which is shown by the ration below, would give equally good results, whilst being cheaper and safer to use.

					<i>Digestible Proteid.</i>		<i>Digestible Carbo-Hydrates and Fats.</i>
2 lb. bran	...	...	...	...	0·212	× 5	= 1·060
2 „ middlings	...		...	...	0·276	× 4	= 1·104
2 „ Sussex ground oats	...		...	...	0·160	× 7	= 1·120
3 „ maize meal	...		...	...	0·213	× 11	= 2·343
1 „ alfalfa (lucerne)	...		...	...	0·032	× 2	= 0·064
1 „ fish meal	...		...	...	0·727	× 0	= 0·000
1 „ wheat	...		...	...	0·204	× 7	= 1·428
1 „ oats	...		...	...	0·080	× 7	= 0·560
1 „ maize (kibbled)	...		...	...	0·071	× 11	= 0·781
					1·975		8·460

therefore nutritive ratio of total day's ration

= 1 :  $\frac{8·460}{1·975}$  = 1 : 4·28.

Neither the composition of the egg nor of the body of the hen is a correct guide in deciding upon a suitable nutritive ratio. The following figures show the composition of the egg and also of the hen's body:—

*Egg*:—Protein 11.1, Fat 10.12, Ash 1.0

$$\text{therefore nutritive ratio} = 1 : \frac{10.12 \times 2.5}{11.1} = 1 : 2.28$$

*Fowl*:—Protein 12.49, Fat 2.98, Ash 0.57

$$\text{therefore nutritive ratio} = 1 : \frac{2.98 \times 2.5}{12.49} = 1 : 0.59$$

Based on this analysis, the nutritive ratio of the egg itself is very high, namely, 1 to 2.28 whilst that of the body of the fowl is even higher, 1 to 0.59. To feed laying hens on a ration possessing so narrow a nutritive ratio as either of these would not only be likely to endanger the health of the birds, but would be a wasteful and expensive method of feeding.

It should be clearly understood that the nutritive ratio is not a complete guide to the feeding value of a ration. Such questions as bulk, the inclusion of mineral salts, palatability and general suitability as a poultry food must also be taken into consideration, but generally speaking, the nutritive ratio is a useful guide to the poultry-keeper in making up his rations.

Much doubt exists in the minds of many poultry-keepers as to which is the cheapest food stuff to buy at the various market prices quoted, and in "*Rations for Livestock*," column 17 of the tables shows the "linseed cake equivalent" of many of the feeding stuffs. The figures in this column give the number of lb. of average linseed cake required to produce in quadrupeds as much growth, fat, milk or work as 100 lb. of the feeding stuff to which the figures apply, and so they permit a reliable comparison of the productive value of different feeding stuffs. As linseed cake is not used, except perhaps to a negligible extent, in feeding poultry, maize meal has been taken for comparison for the tables of this leaflet. The last column of the tables shows approximately the number of lb. of maize meal which have the same productive value as 100 lb. of the feeding stuff indicated. It should not be inferred from these figures that maize meal should be given undue prominence in a ration, or that it should be used to an undue extent by itself; but other considerations being equal, the figures show the relative value of maize meal compared to other feeding stuffs in a poultry ration. The maize meal equivalent is also useful for arriving at a rough estimate as to the cheapest feeding stuffs in the market. Strictly speaking, the manurial value should be taken into con-



sideration before this comparison is made, but since poultry manure at present is not regarded by the poultry-keeper as of the same importance as the farmer regards farmyard manure, this consideration may be ignored at the moment.

Feeding Stuffs.	Chemical Analyses.						Digestible Nutrients.					
	Dry Matter.	Proteid.	Fat.	Soluble Carbo-hydrates.	Fibre.	Ash.	Proteid.	Oil.	Soluble Carbo-hydrates.	Nutritive Ratio.	Maize Meal equivalent (per 100 lb. Maize).	
Cabbage ... ..	11.0	1.5	0.4	5.9	2.0	1.2	1.1	0.2	4.6	1: 6	6.5	
Maize and Maize Meal ... ..	87.0	9.9	4.4	69.2	2.2	1.3	7.1	3.9	65.7	1:11	100.0	
Millet ... ..	87.5	10.6	3.9	61.1	8.1	3.8	8.0	3.1	45.8	1: 7	70.0	
Oats ... ..	86.7	10.3	4.8	58.2	10.3	3.1	8.0	4.0	44.8	1: 7	71.0	
Rye ... ..	86.6	11.5	1.7	69.5	1.9	2.0	9.6	1.1	63.9	1: 7	88.0	
Pasture Grass ... ..	20.0	3.5	0.8	9.7	4.0	2.0	2.5	0.4	7.3	1: 4	10.7	
Rye Grass ... ..	24.8	2.9	0.7	11.5	7.1	2.6	1.8	0.3	7.4	1: 7	8.2	
Clover ... ..	19.0	3.4	0.7	8.1	5.2	1.6	2.5	0.5	6.3	1: 4	9.0	
Meat Meal ... ..	89.2	72.2	13.2	—	—	3.8	67.2	12.5	—	—	114.0	
Fine Middlings ... ..	87.3	15.7	3.4	64.0	1.8	2.4	13.2	3.0	52.0	1: 5	89.0	
Coarse Middlings or Sharps	86.5	16.4	5.0	56.2	3.3	8.6	13.8	4.3	45.5	1: 4	75.0	
Pollards ... ..	86.7	14.3	4.8	55.6	7.7	4.3	11.6	4.0	44.5	1: 5	69.0	
Yeast (dried) ... ..	95.7	48.5	0.5	35.5	0.5	10.7	41.6	0.2	29.2	1: 1	86.0	
Blood Meal ... ..	86.0	81.0	0.8	1.5	—	2.7	72.7	0.8	—	—	78.0	
Wheat ... ..	86.6	12.1	1.9	69.0	1.9	1.7	10.2	1.2	63.5	1: 7	88.0	
Sunflower Seed ... ..	92.5	14.2	32.3	14.5	28.1	3.4	12.8	30.7	10.3	1: 8	118.0	
Distillers' Grains (wet) ... ..	26.2	8.4	3.0	10.4	3.6	0.8	6.2	2.6	6.4	1: 2	18.0	
Distillers' Grains (dry) ... ..	92.0	27.7	11.6	40.8	10.1	1.8	19.6	10.2	25.3	1: 3	65.0	
Buckwheat ... ..	85.9	11.3	2.6	54.8	14.4	2.8	8.5	1.9	42.3	1: 6	62.0	
Barley and Barley Meal ... ..	85.1	8.6	1.5	67.9	4.5	2.6	6.5	1.2	62.2	1:10	85.0	
Dari ... ..	88.9	9.6	3.8	71.2	1.9	2.4	7.7	3.0	60.5	1: 9	91.0	
Rice ... ..	87.4	6.7	0.4	78.0	1.5	0.8	5.8	0.2	75.8	1:13	100.0	
Beans and Bean Meal ... ..	85.7	25.4	1.5	48.5	7.1	3.2	20.1	1.2	44.1	1: 2	77.0	
Peas and Pea Meal ... ..	86.0	22.5	1.6	53.7	5.4	2.8	19.5	1.0	49.9	1: 3	83.0	
Hemp Seed ... ..	91.1	18.2	32.6	21.1	15.0	4.2	13.7	29.3	16.8	1: 7	117.0	
Soya Beans ... ..	90.0	33.2	17.5	30.5	4.1	4.7	29.5	15.8	20.8	1: 2	96.0	
Soya Bean Meal ... ..	88.7	44.7	1.5	31.9	5.1	5.5	40.3	1.4	24.7	1: 1	87.0	
Milk (sweet) ... ..	12.8	3.4	3.9	4.8	—	0.7	3.2	3.9	4.8	1: 4	21.3	
Milk (skim) ... ..	10.0	3.5	0.4	5.0	—	0.8	3.3	0.4	5.0	1: 2	11.4	
Linseed ... ..	92.8	24.2	36.5	22.9	5.5	3.8	19.4	34.7	18.3	1: 5	134.0	
Linseed Meal ... ..	88.2	35.7	3.1	33.9	9.0	6.5	30.8	2.8	27.2	1: 1	74.0	
Buttermilk ... ..	9.2	3.6	0.8	4.1	—	0.7	3.4	0.8	4.1	1: 2	11.4	
Maize Germ Meal ... ..	89.3	13.0	13.5	55.1	4.1	3.6	10.4	12.8	45.8	1: 7	103.0	
Barley Brewers Grain (dry) ... ..	89.7	18.3	6.4	45.9	15.2	3.9	13.0	5.6	27.6	1: 4	51.0	
Barley Brewers Grain (wet) ... ..	32.4	7.5	2.8	14.6	6.1	1.4	5.5	2.4	9.1	1: 3	20.0	
Barley Malt Culms ... ..	90.0	24.4	2.0	42.4	14.0	7.2	19.9	1.5	30.9	1: 3	38.3	
Fish Meal ... ..	87.0	55.6	4.4	2.1	—	2.7	72.7	0.8	—	—	65.0	
Maize Gluten Feed ... ..	89.6	23.5	3.4	56.7	3.5	2.5	20.0	2.7	49.3	1: 3	91.0	
Maize Gluten Meal ... ..	90.9	35.5	4.7	47.5	2.1	1.1	30.6	4.4	42.6	1: 2	101.0	

Price comparison is arrived at in the following manner:—  
If the price of maize meal is £10 5s. 0d. per ton and the price of feed oatmeal £11 15s. 0d. per ton, on referring to the table we find that the maize equivalent of oats is 71, i.e., 71 lb. of maize meal is of the same productive value as 100 lb. of oats; the price of feed oatmeal, namely, £11 15s. 0d. is therefore

divided by 71, showing that the cost per unit of maize meal equivalent in oats is about 3s. 4d. The cost per unit of maize meal would be £10 5s. 0d. divided by 100, namely, approximately 2s., so that unless the poultry-keeper for some particular reason desires to use feed oatmeal instead of maize meal, maize meal is much the cheaper purchase at these prices.

Feeding Stuffs.	Chemical Analyses.						Digestible Nutrients.				
	Dry Matter.	Proteid.	Fat.	Soluble Carbo-hydrates.	Fibre.	Ash.	Proteid.	Oil.	Soluble Carbo-hydrates.	Nutritive Ratio.	Maize Meal equivalent (per 10 lb. Maize)
Sussex Ground Oats ...	86.7	10.3	4.8	58.2	10.3	3.1	8.0	4.0	44.8	1: 7	71.0
Oatmeal ...	91.4	14.0	9.4	65.0	1.2	1.8	—	—	—	—	—
Groats ...	91.6	14.3	8.7	65.0	1.8	1.4	—	—	—	—	—
Wheat Bran ...	86.4	13.5	3.9	53.0	10.6	5.4	10.6	2.8	38.0	1: 5	53.0
Clover Meal ...	83.5	13.5	2.9	37.1	24.1	6.0	8.5	1.7	26.0	1: 5	26.0
Turnips ...	8.5	1.0	0.2	5.7	0.9	0.7	0.6	—	5.2	1: 9	5.7
Swedes ...	11.5	1.3	0.2	8.1	1.2	0.7	1.1	—	7.5	1: 7	8.1
Mangolds ...	13.2	1.2	0.1	10.2	0.8	0.9	0.7	—	9.4	1:14	8.1
Potatoes ...	23.8	2.1	0.1	19.7	0.9	1.0	1.1	—	17.7	1: 1	22.2
Parsnips ...	15.0	1.3	0.3	11.3	1.2	0.9	1.0	0.1	10.9	1:12	12.4
Carrots ...	13.0	1.2	0.2	9.3	1.4	0.9	0.8	0.1	8.9	1:12	10.4
Kohl Rabi ...	12.7	2.0	0.1	8.2	1.4	1.0	0.7	—	7.4	1:11	9.0
Mangolds (Yellow-fleshed Globe or Tankard) ...	13.2	1.2	0.1	10.2	0.8	0.9	0.7	—	9.4	1:14	8.1
Mangolds (Long Red) ...	13.1	1.0	0.1	10.3	0.8	0.9	0.7	—	9.5	1:14	8.1
Kohl Rabi (leaves) ...	13.5	2.8	0.4	7.1	1.6	1.6	1.9	0.2	5.7	1: 4	7.3
Kale (Thousand Head) ...	14.8	2.5	0.3	8.7	1.7	1.6	1.8	0.2	7.0	1: 5	9.3
Rape ...	14.1	2.8	0.8	5.7	3.5	1.3	2.0	0.5	3.9	1: 3	6.3
Lucerne (beginning to flower) ...	24.0	4.5	0.8	9.6	6.8	2.3	3.2	0.4	6.3	1: 3	7.7
Clover (Alsike) ...	15.0	3.3	0.6	5.1	4.5	1.5	2.1	0.4	3.6	1: 3	5.7
„ (Crimson) ...	18.5	2.8	0.7	6.9	6.2	1.9	2.1	0.5	5.2	1: 5	6.7
Lucerne (before flowering) ...	24.0	4.5	0.8	9.6	6.8	2.3	3.2	0.4	6.3	1: 2	7.7
„ (in full flower) ..	24.0	3.9	0.8	9.3	7.8	2.2	2.7	0.4	5.7	1: 3	7.7
Palm Nut Kernels ...	91.6	8.4	18.8	26.8	5.8	1.8	8.0	46.5	22.5	1:16	17.4
Cocanut Cake Meal ...	88.7	19.5	6.7	42.5	13.6	6.4	15.3	6.5	35.4	1: 4	81.0
Hemp Seed Meal ...	88.7	34.8	1.7	16.8	25.7	9.3	26.2	1.3	8.9	1: 1	36.8
Palm Nut Kernel Meal (extracted) ...	90.0	19.0	2.0	49.0	16.0	4.0	17.1	1.9	43.5	1: 3	79.0
Rape Meal (extracted) ...	89.3	36.9	3.1	32.7	9.3	7.3	30.7	2.4	26.2	1: 1	66.0
Sunflower Cake (decorticated) ...	90.4	37.4	13.8	20.4	12.1	6.7	33.6	12.2	14.6	1: 1	86.2
Sesame Meal (extracted) ...	94.0	46.4	2.4	26.7	7.7	10.8	41.8	2.2	14.9	1: 1	69.0
Apple Pomace (fresh) ...	25.8	1.5	1.1	17.1	4.7	1.4	0.7	0.5	11.9	1:18	15.4
„ (dried) ...	88.3	4.0	3.5	51.8	27.2	1.8	1.6	1.7	36.3	1:26	38.2
Maize Malt Culms ...	86.5	20.7	14.5	39.6	5.8	5.9	17.4	12.4	34.9	1: 4	68.8
Maize Meal (from cornflour) ...	85.0	9.2	3.8	68.7	1.9	1.4	5.5	3.5	63.7	1:13	96.0
Rice Feeding Meal ...	87.4	12.0	12.0	45.2	8.0	10.2	6.8	10.2	36.2	1: 9	83.0

Take again a comparison between the grains dari and maize. If the price of dari be £9 per ton and maize £9 10s. 0d. per ton, then the price per unit of maize meal equivalent in dari is £9 divided by 91, which equals, roughly, 2s., whilst the price



per unit of maize at £9 10s. 0d. per ton is about 1s. 11d., and on this basis maize is a cheaper grain for the poultry-keeper to purchase than dari.

**General.**—Methods of feeding poultry in practice are largely influenced by considerations of economy in labour and by the system of poultry-keeping adopted. Where poultry are kept merely as a subsidiary occupation or in very small numbers merely for the purpose of the family supply, economy in labour is not of such vital importance as it is on a large commercial egg farm, where thousands of birds are kept and reared. In the latter case all superfluous work must be rigidly cut out and the routine of the farm organised in such a way that, with due regard to efficiency, labour is cut down to the absolute minimum.

Again, where the poultry enjoy free range over an ordinary mixed farm and are thus enabled to find a great deal of their own food, the methods of feeding adopted differ considerably from those of the average commercial egg farm, where the birds are more or less permanently confined on limited areas of land.

The conditions under which poultry are kept in this country vary so widely and there is such a large variety of feeding stuffs which can successfully be utilised for poultry, that in an article of this character the subject of feeding can only be treated upon general lines and no definite rules can be laid down as to the best methods of feeding or the best rations to employ.

In the case of backyard poultry-keepers, who wish to use household scraps and surplus material from the garden and allotment, it is impossible to lay down definite rules for the practical application of the foregoing principles, as the quality and quantity of the materials available for use vary so greatly. It should, however, be remembered that meat and fish scraps are rich in proteids and therefore tend to narrow the nutritive ratio, whilst material of a vegetable character will tend to widen it.

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## MONTHLY NOTES ON FEEDING STUFFS.

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**Feeding Value of Alfalfa Meal.**—A correspondent has asked for information on the value of alfalfa meal for poultry, and cows and pigs in winter. Alfalfa is best known in this country as lucerne, and alfalfa meal consists of the dried lucerne plant disintegrated into a meal. Like clover meal it is chiefly used

for poultry kept on an intensive or semi-intensive system, where supplies of green food are scarce or not available. At 18s. 6d. per cwt., the price quoted by the correspondent, the cost per unit starch equivalent works out at no less than 12s. It is, therefore, a very dear feeding stuff, and in the case of pigs and cows it would be more advantageous to feed lucerne hay rather than lucerne meal, if it is desired to feed this material at all. Green lucerne is very useful as a supplement to any rations containing maize or maize meal, since, besides supplying protein it is fairly rich in the ash constituents needed by growing stock.

**Use of Cod Liver Oil and Fish Meal.**—Recent work carried out at the Rowett Research Institute, Aberdeen, and reported in the Scottish Journal of Agriculture, deals with the value of cod liver oil for feeding purposes, and the connection between fish meal feeding and taint in bacon.

In the poultry tests, feeding tests were carried out concurrently at the three Scottish Colleges of Agriculture, and at the Rowett Institute, the object being to test the influence of cod liver oil on (a) growth, (b) egg production, and (c) hatchability of eggs. The basal ration used was the diet usually fed at each station, and cod liver oil was added in small amounts (usually 1 c.c. per bird).

*Growth.*—The results of these tests indicate that, with an ordinary commercial diet, there is no material advantage gained in feeding cod liver oil. In the tests in question, the control birds without cod liver oil put on as much weight as those with.

*Egg Production.*—In these tests, the birds were kept under strictly controlled conditions, and the results obtained showed no evidence of any beneficial effects that could be ascribed to either cod liver oil or linseed oil.

*Hatchability.*—With regard to this experiment eggs from hens in the egg production experiment were hatched to see whether the cod liver oil or linseed oil had any influence on the hatchability of the eggs. From the data at present available it would appear that the percentage hatchability was not increased by the use of either cod liver oil or linseed oil.

*Fish Meal and Taint in Bacon.*—Pig feeding experiments were carried out at the Rowett Institute to determine (1) whether fishy taste in bacon was caused by the addition of fish oil to the diet of pigs, and (2) whether the addition of fish oil results in improved health or rate of growth. The space at the writer's disposal does not allow a comprehensive treatment of these



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit. Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.					
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British -	—	—	11/6	11 10	0 16	10 14	71·6	3/-	1·61
Barley, British Feeding	—	—	9/3	9 5	0 12	8 13	71	2/5	1·29
„ Danubian „	30/-	400	8/6	8 10†	0 12	7 18	71	2/3	1·20
„ Persian „	27/0	„	7/7	7 12	0 12	7 0	71	2/-	1·07
Oats, English White -	—	—	11/6	11 10	0 14	10 16	59·5	3/8	1·96
„ „ Black & Grey	—	—	11/2	11 3	0 14	10 9	59·5	3/6	1·87
„ Scotch White	—	—	12/8	12 13	0 14	11 19	59·5	4/-	2·14
„ Canadian No. 2	—	—	—	—	—	—	—	—	—
„ Western	29/3	320	10/3	10 5	0 14	9 11	59·5	3 3	1·74
„ No. 3 „	27/9	„	9/9	9 15	0 14	9 1	59·5	3/1	1·65
„ Feed -	27/3	„	9/6	9 10	0 14	8 16	59·5	2/11	1·56
„ American -	25/6	„	8/11	8 18	0 14	8 4	59·5	2/9	1·47
„ Argentine -	24/6	„	8/7	8 12	0 14	7 18	59·5	2/8	1·43
Maize, American -	41/-	480	9/7	9 12	0 13	8 19	81	2 3	1·20
„ Argentine -	41/3	„	9/7	9 12	0 13	8 19	81	2/3	1·20
Beans, Rangoon -	—	—	8/3	8 5	1 13	6 12	67	2/-	1·07
Millers' offals—	—	—	—	—	—	—	—	—	—
„ Bran, British -	—	—	—	6 0	1 8	4 12	45	2/1	1·12
„ „ Broad -	—	—	—	7 0	1 8	5 12	45	2/6	1·34
„ Fine middlings (Im- ported) -	—	—	—	8 10	1 3	7 7	72	2/1	1·12
„ Coarse middlings (British) -	—	—	—	8 0	1 3	6 17	64	2/2	1·16
„ Pollards (Imported)	—	—	—	6 2	1 8	4 14	60	1/7	0·85
Barley Meal -	—	—	—	9 12	0 12	9 0	71	2/3	1·34
Maize „ -	—	—	—	10 5	0 13	9 12	81	2/4	1·25
„ Germ Meal -	—	—	—	8 12	1 0	7 12	85·3	1/9	0·94
„ „ Gluten-feed -	—	—	—	8 15	1 7	7 8	75·6	1/11	1·03
Locust Bean Meal -	—	—	—	8 0	0 10	7 10	71·4	2/1	1·12
Bean Meal -	—	—	—	12 7	1 13	10 14	67	3/2	1·70
Fish „ -	—	—	—	16 5	4 9	11 16	53	4/5	2·37
Linseed -	—	—	—	21 0	1 12	19 8	119	3/3	1·74
„ „ Cake, English (9°/o oil)	—	—	—	10 10	1 19	8 11	74	2/4	1·25
Cottonseed Cake, English (Egyptian Seed)	—	—	—	—	—	—	—	—	—
„ „ „ (5½°/o oil)	—	—	—	7 5	1 16	5 9	42	2/7	1·38
„ „ „ (5½°/o oil)	—	—	—	7 2	1 16	5 6	42	2/6	1·34
Coconut Cake (6°/o oil)	—	—	—	8 7	1 11	6 16	73	1/10	0·98
Palm Kernel Cake (6°/o oil)	—	—	—	5 10*	1 4	4 6	75	1/2	0·62
„ „ „ Meal (2°/o „)	—	—	—	4 17	1 5	3 12	71·3	1/-	0·54
Feeding Treacle -	—	—	—	5 2	0 9	4 13	51	1/10	0·98
Brewers' grains, dried, ale	—	—	—	6 7	1 4	5 3	49	2/1	1·12
„ „ „ „ porter	—	—	—	5 17	1 4	4 13	49	1/11	1·03
„ „ „ „ wet, ale	—	—	—	0 17	0 9	0 8	15	0/6	0·27
„ „ „ „ wet, porter	—	—	—	0 15	0 9	0 6	15	0/5	0·22
Malt Culms -	—	—	—	8 0*	1 15	6 5	43	2/11	1·56

\* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of June and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 1d.; P<sub>2</sub>O<sub>5</sub>, 4s. 4d.; K<sub>2</sub>O, 3s.

tests, but the main facts are as follows:--4 groups of pigs were fed, the main diet being a mixture of maize 10 parts, oats 1 part, sharps 1 part, fish meal 2 parts. In addition, Group 1 received cod liver oil (2 oz. to every 15 lb. of mixed meals); Group 2 herring oil; Group 3 olive oil; Group IV maize. The maize given to Group IV was added in amount sufficient to yield the same starch value as the oils.

The rates of gain in weight of the four lots were uniform, the addition of vitamin A rich cod liver oil, for the period under test, showing no beneficial result.

The amount of oil fed to one pig out of each group was increased towards the end of the test to 1 $\frac{3}{4}$  oz. per day to intensify any possible tainting effect that might be produced. The bacon from all the pigs was too oily. The bacon from the herring oil group had a markedly offensive fishy taste and was quite uneatable. The cod liver oil group also had a distinct fishy taste. In a previous experiment at the Rowett Institute it was shown that taint was produced from fish meal containing 6.4 per cent. of oil, but not from that containing only 2.3 per cent. of oil. The results of these experiments indicate that the oil in fish meal is the source of taint, and the tendency of fish meals to cause a taint in bacon is in proportion to the percentage of oil present.

FARM VALUES.

CROPS:	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s.	£ s.	£ s.		s. d.	d.
Wheat - - - - -	8 17	0 16	8 1	71.6	2 3	1.20
Oats - - - - -	7 8	0 14	6 14	59.5	2 3	1.20
Barley - - - - -	8 12	0 12	8 0	71.0	2 3	1.20
Potatoes - - - - -	2 4	0 4	2 0	18.0	2 3	1.20
Swedes - - - - -	0 18	0 2	0 16	7.0	2 3	1.20
Mangolds - - - - -	0 17	0 3	0 14	6.0	2 3	1.20
Good Meadow Hay - -	3 19	0 14	3 5	31.0	2 1	1.12
Good Oat Straw - - -	2 2	0 7	1 15	17.0	2 1	1.12
Good Clover Hay - - -	4 8	1 1	3 7	32.0	2 1	1.12
Vetch and Oat Silage - -	1 18	0 8	1 10	14.0	2 2	1.16

\* \* \* \* \*



## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending July 11th.				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ... ..	13.10	13.15	13.10	12.17	16. 7
„ „ Lime (N. 13 per cent.) ... ..	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.12*	13.12*	13.12*	13.12*	(N)13. 1
„ „ „ neutral (A. 25¾ per cent.)	14.15*	14.15*	14.15*	14.15*	(N)13.11
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	1.17	3. 0
„ „ (Pot. 14 per cent.) ... ..	2. 5	2. 1	2.10	2. 5	3. 3
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15†	11.15	11. 0	4. 7
Basic Slag (T.P. 35 per cent.) ... ..	...	...	...	3.12§	2. 1
„ „ (T.P. 30 per cent.) ... ..	...	...	...	3. 0§	2. 0
„ „ (T.P. 26 per cent.) ... ..	2.13§	2.10§	...	...	...
„ „ (T.P. 24 per cent.) ... ..	2. 9§	2. 6§	2. 7§	...	...
„ „ (T.P. 20-22 per cent.) ... ..	...	2. 3§	...	2. 7§	2. 4
„ „ (T.P. 18 per cent.) ... ..	2. 3§	...	2. 0§	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	3.15	2. 2
„ „ (S.P. 30 per cent.) ... ..	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.) ... ..	9.10	9.10†	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7. 2†	7. 0	6.10	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

\* \* \* \* \*

THE New Zealand Government have notified the Ministry that the shipment of cattle, sheep and pigs from this country to the Dominions will in future be subject to the following conditions:—

### Shipment of Live Stock to New Zealand.

(1) For one month from the date of an outbreak of Foot-and-Mouth Disease no shipments may be made: provided, however, that an outbreak in one country shall not be held to prohibit shipments from the others—e.g., an outbreak in England will not prevent shipments of cattle, etc., from Scotland or Ireland.

(2) After one month from the date of the last outbreak, cattle, sheep or pigs may be shipped at London, Liverpool or Glasgow to New Zealand from any part of the country, provided that, until three months have elapsed from the date of an outbreak, no shipment shall be made of cattle, sheep or pigs

which have been, since the date of that outbreak, within a radius of 15 miles round the seat of the outbreak.

(3) Provided that special authority may be given to permit shipment of cattle, sheep or pigs from approved areas after segregation in approved premises at the port of loading for 14 days, provided that during that period outbreaks of Foot-and-Mouth Disease had not occurred at the port of segregation nor in the areas from which any of the animals originated, nor had become epidemic in character.

(4) The fodder accompanying the animals must be the product of a county where no Foot-and-Mouth Disease has existed for six months prior to date of shipment, and must be sent *direct* from such county to the ship's side, accompanied by a statutory declaration from the supplier as to its origin.

It will be necessary for the New Zealand Government Veterinary Officer (New Zealand Government Offices, 415, Strand, London, W.C.2.) to be personally satisfied as to origin of any fodder shipped, and approval must be obtained in each case before definite arrangements are made as to purchase.

The above also applies to fodder accompanying horses.

(5) No fodder will be allowed to be landed in New Zealand.

(6) The usual owner's declaration and Veterinary Certificates must be furnished.

\* \* \* \* \*

THE Ministry desires to draw the attention of farmers and flock owners to the damage which is caused to the wool and skin of sheep by careless pitch-branding. From information which the Ministry has received, it is very evident that considerable damage and loss are annually incurred from this cause, and an examination of pelts shows that in many cases the branding iron has inflicted a wound which has so marked the skin that the dressed pelt is useless for any good class of trade. The consequent serious loss could easily be obviated if branding were carefully done. Neither branding iron nor pitch should be so hot as to burn the skin, but just hot enough to leave a clean neat mark. Burning is especially apt to occur if branding is done at clipping time or too soon after clipping, and farmers should therefore be careful not to perform clipping and branding at the same time. The best time to brand sheep is a week or two after clipping, when the wool has grown a little.

There is reason to believe that hill sheep are more liable to be damaged by pitch branding than the better conditioned sheep of the lowlands, but if sufficient care is not taken lowland sheep will be damaged no less than the others. An investigation is being made with a view to finding some satisfactory alternative method of marking sheep. The difficulty in the past has been that while pitch or tar branding is liable to spoil both the wool



and the pelt, alternative preparations have proved to be non-permanent or to be otherwise unserviceable.

\* \* \* \* \*

It is expected by the World's Dairy Congress Committee for England and Wales that about 30 persons from this country will form the English delegation to the World's Dairy Congress to be held at Washington on 2nd and 3rd October, at Philadelphia on 4th October, and at Syracuse on 5th-10th October next.

**The World's  
Dairy Congress.**

The opportunity will be taken by some members of the delegation of visiting places of general interest in the United States. At Washington, the delegates will have an opportunity of inspecting the Government's laboratories and experimental stations, &c. At Syracuse, the National Dairy Exposition will be held at the same time as the Congress and complete exhibits in connection with various branches of the milk industry in the United States and Canada, from dairy cattle to the latest machinery for the manufacture of dairy products, will be on view. There will be an international dinner on the evening of 10th October, at which it is expected representative dairy scientists and industrial leaders from all parts of the world will be assembled. Any further information can be obtained from the Secretary of the Committee for England and Wales at the offices of the Ministry of Agriculture, 10, Whitehall Place, S.W.1.

\* \* \* \* \*

THE high form of intensive cultivation practised by glasshouse growers has problems of its own which are not easily dealt with at any of the ordinary Agricultural Research Stations, and the industry was particularly fortunate in being able to set up a special station at Cheshunt to investigate problems associated with glasshouse crops.

**Report of the  
Experimental and  
Research Station,  
Cheshunt.**

The Station has made very considerable progress, and its Eighth Annual Report (1922) contains much valuable information relating to the tomato and cucumber crops and their diseases. The Director has given some interesting notes on "Mosaic Disease," which, though commonly associated with potatoes, yet, nevertheless, attacks other plants, including tomatoes and cucumbers. The experiments on this disease recorded in the report are a valuable addition to our knowledge of the subject.

The Station has received a special grant from the Ministry to study the effect of charging the atmosphere in which the plants are growing with large amounts of carbon dioxide gas, and the report gives an account of the preliminary investigation that has been made. This is a particularly important problem which has been arousing much interest in the industry.

Certain pests, like wood-lice and red spider are ever troublesome to glasshouse crops, and growers will therefore welcome the recommendations for their control made by the Station Entomologist.

Generally, the report is an extremely helpful and important contribution to literature on glasshouse cultivation; and the logical way in which the recommendations have been drawn from the results of experiments will be convincing to the practical grower.

\* \* \* \* \*

THE Ministry has received the approval of the Treasury and the Development Commission to a total capital expenditure of

**Poultry Research.** £4,850 on a scheme for assisting scientific research in poultry breeding, nutrition, and disease. The breeding and nutrition research work under the scheme will be carried on at the Cambridge School of Agriculture, and the disease research work at the Ministry of Agriculture's Veterinary Laboratory at New Haw, Weybridge. One-fourth of the total capital expenditure will be contributed by the poultry industry itself, and this amount will be collected by the National Poultry Council. The remaining three-fourths will be a grant from the Development Fund out of the moneys provided for agricultural development and research under the Corn Production Acts (Repeal) Act, 1921. The entire cost of maintenance will be provided out of the same fund until 31st March, 1927.

The Scheme also provides for poultry educational work and commercial experiments at Harper Adams Agricultural College, Newport, Salop, for practical breeding experiments for egg-production at a centre in the North of England, and for experiments in breeding for table poultry production at a centre in the South of England. Arrangements are, however, not yet complete for a beginning to be made on these three subsidiary parts of the scheme.

\* - \* \* \* \*



EXPERIMENTS in the preservation of eggs were carried out in the Poultry Department of Cornell University, U.S.A., in 1916-1918, and the results are described in the **Experiments in the Preservation of Eggs.** Journal of the American Association of Instructors and Investigators in Poultry Husbandry for June, 1919.

The treatments tried were:—dipping in hot water for six seconds, dipping in boiling water for six seconds, coating with vaseline, coating with paraffin wax and with a mixture consisting of five parts vaseline to two parts paraffin wax, and preserving in solutions of sodium compounds. After treatment some of the eggs were kept under cellar conditions and some in cold storage.

One very striking fact brought out was that paraffin wax apparently had a detrimental effect on the eggs which were treated with it. One lot of eggs was dipped in melted paraffin wax so that each egg was entirely coated. Half of these eggs were placed in cold storage and the other half kept under cellar conditions. When these eggs were examined it was found that all of them were rotten. It would seem, therefore, that coating with paraffin wax is worse than useless since the cold storage eggs which were not treated at all were mostly fit to eat. One lot of eggs was then coated with a mixture of vaseline and paraffin wax in the proportion of five to two, and half the eggs were placed in cold storage and the rest kept under cellar conditions. Of the eighty eggs kept under cellar conditions all but twelve were rotten, and these twelve were not fit to eat. Of the eggs kept in cold storage only 9.1 per cent. were fit for use, the balance being either sour or musty, although their candled appearance was fairly good. Another lot of eggs was treated with vaseline alone, and kept in cold storage for fifteen days longer than the lot just mentioned. These kept in much better condition, only 2.6 per cent. being unfit for consumption as against 90.8 of the former lot. This seems to show that paraffin wax promotes decay in eggs which are stored for long periods.

Treatment of eggs with oil or vaseline apparently improves the keeping quality. Eggs were dipped in hot oil for six seconds and then placed in cold storage, while others were coated with vaseline and placed in cold storage. Both of these were much better than the untreated cold storage eggs. Some of the eggs which were treated with hot oil were kept under cellar conditions and only 8.7 per cent. were found to be unfit for use, where untreated eggs would no doubt have been either entirely dried

up or rotten. The chief objection to the use of oil or vaseline is that the appearance of the egg is spoiled by the glassy look. Dipping in hot water instead of hot oil is quite satisfactory except that the air cells are nearly as large as in untreated cold storage eggs and are more apt to be broken than in the case of the oil-treated eggs. So far as the quality of the eggs is concerned there is very little difference between the two methods of treatment.

Another interesting fact which was brought out is that sealing eggs in fruit jars is a poor method of preservation. A number of eggs treated with hot oil and some which had been immersed in hot water were sealed in glass fruit jars and part kept in the cellar and part in a room which was much colder than an ordinary cellar. When examined at the end of nine months, all of these eggs were rotten.

Another section of the trials dealt with the use of solutions containing sodium, in order to test a theory that the sodium in the water-glass used for home preservation is the chief cause of its preservative effect and therefore any sodium compound would do as well as water-glass. Acting on this suggestion, the following compounds containing sodium were tried:—ordinary hard soap, sodium carbonate and sodium benzene sulphanate. Sodium salicylate was also considered, but was found to be too expensive to be practical. The solutions were made up so that they contained practically the same amount of sodium as the water-glass solution. The results obtained were that eggs preserved in the soap solution were fully as good as those preserved in water-glass, while those in the sodium carbonate and sodium benzene sulphanate were all spoiled. The reason for this difference appeared to be that in the case of the soap solution a coating of what was judged to be a calcium soap had formed on the shell of the eggs. Moreover, the solution had thickened in a manner similar to the thickening of the water-glass solution, so that none of the solution had entered the egg. On the other hand, both of the other solutions remained watery and in both cases the solutions had entered the eggs and spoiled them for eating. Moreover, in the case of the sodium benzene sulphanate no germicidal effect was observed, but on the contrary bacteria appeared to be encouraged by it.

So far as the experiments have been carried, therefore, the results are chiefly negative, but two interesting effects have been noticed. The first is that paraffin wax for some reason has a bad effect upon eggs. The second is that apparently it



is not the sodium in water-glass which alone has the preservative effect: it is rather the combination of the silica, stopping up the pores, and the sodium, preventing the growth of bacteria in the solution, which keeps the eggs fit to eat.

\* \* \* \* \*

## AGRICULTURE ABROAD.

AN interesting Act providing for Agricultural Education has recently been passed by the Federal Parliament of Queensland,

### **Agricultural Education in Queensland.**

the objects of which are to fit boys to follow agricultural pursuits, to train girls in domestic science, and to enable the more advanced students to take degrees

and diplomas in agriculture. The Act provides for the setting up of a temporary Board of Agricultural Education, whose chief functions are to advise as to the allocation of moneys voted by Parliament for the purpose of agricultural education, to investigate and report on the establishment and administration of agricultural schools and classes, and to issue bulletins dealing with agricultural education and cognate subjects. At a later date the Board may be superseded and its functions discharged by a Superintendent of Agricultural Education appointed by the Governor in Council.

Upon the recommendation of the Board of Agricultural Education, the Governor in Council may establish whole or part-time agricultural schools, day or evening classes, and hostels for the accommodation of the students. In addition, "any society, association, or body of persons" may make application for the establishment of an agricultural school or agricultural classes in a particular locality, and, providing *inter alia* the applicants can produce satisfactory evidence that they have already raised a sum of money equal at least to one-third of the estimated capital expenditure, the Governor in Council may, on the recommendation of the Board, establish such schools or classes, and may contribute the balance of the sum required. The whole annual cost, upkeep and maintenance of these schools or classes will be defrayed out of State funds. The schools and classes are to be subject to State supervision and inspection, the Committees of Management being constituted and appointed in such manner as the Governor in Council may approve, after consultation with the Board. The agricultural education so provided is, with few exceptions, to be free.

Provision is also made in the Act for the contribution of a sum, not exceeding two-thirds of the capital cost, towards providing an agricultural section or agricultural classes in State-aided Grammar Schools and Technical Colleges.

\* \* \* \* \*

THE new Customs Tariff of the United States of America, which came into force on 22nd September, 1922, provides that any animal

**Importation of  
Pure-bred Live  
Stock into the  
United States.**

imported by a citizen of the United States specially for breeding purposes shall be admitted free, provided that it is pure bred, of a recognised breed, and duly registered in a book of record recognised by the U.S. Secretary of Agriculture for that breed. Otherwise, the duties on live stock are as follows:—cattle weighing less than 1,050 lb., 1½ cents per lb.; weighing 1,050 lb. or more, 2 cents per lb.; sheep and goats, 2 dollars per head; swine, ½ cent. per lb.

The U.S. Department of Agriculture has now issued regulations (B.A.I. Order No. 278) laying down the procedure that must be followed to secure duty-free importation:—

Under these regulations the Bureau of Animal Industry is authorised to issue certificates of pure breeding. To obtain these certificates importers have to apply to the Bureau in a prescribed form giving particulars as to the animals to be imported. With the application certificates of registration and pedigree, issued by the custodian of one of the books of record referred to below, are to be furnished to the Bureau with an affidavit from the owner, agent or importer that the animals so imported are the identical animals described in the certificates of record and pedigree.

The Bureau also requires with the application a certificate from the seller or his agent giving the breed, sex, name, and registry number of each animal sold to the importer, the date of sale, the place of purchase, and the name and address (in the United States) of the purchaser.

If the application is found satisfactory certificates to that effect will be issued and forwarded to the Collector of Customs at the port of entry. Certificates of pure breeding will not, however, be issued until the description of the animals taken by an inspector of the Bureau of Animal Industry at the port of entry is received at the Department at Washington.

The Order contains a list of recognised breeds and books of record across the seas. The names of the following British breeds, with the name of the Society publishing the book of record, are included in the list:—

*Cattle*.—Aberdeen-Angus, Ayrshire, Devon, Galloway, Guernsey, Hereford, Highland, Jersey, Kerry and Dexter, Red Poll, Shorthorn, Sussex, Welsh.

*Sheep*.—Cheviot, Cotswold, Dorset Horn, Hampshire Down, Kent or Romney Marsh, Kerry Hill, Leicester, Border Leicester, Lincoln, Oxford Down, Shropshire, Southdown, Suffolk, and Wensleydale.



*Horses.*—Clydesdale, Hackney, Shetland Pony, Shire, Suffolk, Thoroughbred, Welsh Pony, and Cob.

*Pigs.*—Berkshire, Large White (Large Yorkshire), Tamworth.

Before any additional breed can be added to this list the custodian of its book of record must submit to the Department a complete set of the published volumes of such book of record together with all rules affecting the registration of animals. The Department will then consider the case on its merits.

Communications should be addressed to *The Chief of the Bureau of Animal Industry, Department of Agriculture, Washington, D.C.*

\* \* \* \* \*

ONE of the most active of the Lithuanian Ministries is the Ministry of Agriculture, as is appropriate in a country where

**Work of the  
Lithuanian  
Ministry of  
Agriculture.**

the majority of the inhabitants are engaged in agriculture. Its programme includes agricultural education, the training of teachers to give agricultural instruction to pupils in elementary schools, improvement

of live stock, and the encouragement of associations of agriculturists for the purpose of improving Lithuanian agriculture and marketing its products.

The Ministry has founded agricultural courses in many districts and, in order to reach the more remote regions, travelling lecturers are largely employed. The teaching is free to all and lasts three months. In conjunction with the municipalities the Ministry is establishing district grain cleaning stations and measures are being taken for the improvement of live stock. For the latter purpose 90 Middle White, Large White, and Berkshire boars have been bought in England at an average of £17, and a large quantity of Orpington eggs has been imported for sale to poultry-keepers. Among other associations which are aided by the Government, the Shavli Union combines all the district agricultural associations of the northern portion of Lithuania, and is arranging the export of agricultural produce to England.

\* \* \* \* \*

At a recent meeting of the Belgian Central Chamber of Agriculture, M. Rasquin gave an address\* on the depletion of agricultural labour. He indicated that the

**Farm Labour  
in Belgium.**

question was not a new one in Belgium, but that since the War and especially during

last year, the dearth of workers had become a serious menace to the agricultural industry.

\* Published in the March, 1923, issue of the *Journal de la Société Centrale d'Agriculture de Belgique*.

In the polder regions workers crossed the borders into Holland to receive the benefit of increased wages due to the rate of exchange, while in the more urban areas they willingly abandoned the fields for the local factories. In the communes contiguous to railway stations considerable numbers of workers, attracted by increased wages, travelled daily or weekly to the French industrial centres, and so neglected the Belgian countryside. In December over 40,000 labourers travelled to France each week, and of these it is estimated that one-fifth were agricultural workers. During the previous May the exodus increased to 120,000 against 60,000 for the corresponding month before the War.

Although it seemed clear that the better wages and shorter hours of industrial pursuits were the principal causes of the desertion of the farms, the attractions of town pleasures were also held to be a strong contributory cause. The fascination of cinemas in the cities was regarded as being such an important factor in attracting workers from the countryside that France had voted 500,000 francs for the organisation of cinema shows in rural areas. Workers were also introduced to town life through the demands of military service and frequently decided to settle in garrison towns rather than tolerate the inconveniences of separation from their families. The exodus from the countryside was also greatly encouraged by the extensive issue of cheap weekly tickets by the Belgian railways.

As regards possible remedies M. Rasquin proposed that the system of giving bonuses on production might be extended so that agricultural workers would be rewarded for increased production or for reducing labour in any way. The worker should be given every facility for producing his own food, and by working on his own account he would become a collaborator with his employer. The questions of accommodation and housing needed thorough attention. It was suggested further that family allowances should be given after a stay of six months on a farm at the rate of 10 francs per child per month up to a maximum of 40 francs. This system of allowances was already established in the province of Liège and operated in a fairly satisfactory manner.

Above all, the speaker held that every facility should be extended to enable the worker to become a proprietor by offering advances for the purchase of small holdings and by minor concessions such as exemption from stamp duty and registration.

From the agricultural point of view labour exchanges had



proved ineffective as they were located in the big cities, and the only remedy lay in their being subsidised by the Belgian Ministry of Agriculture and set up in the centres of agricultural districts.

It was pointed out that there appeared to be no serious obstacle to following the lead of France and importing Polish labour during the busy seasons. Reports indicated that Polish workers in general gave satisfaction, but it was considered advisable to return imported workers to their own country as soon as the seasonal work was completed, as otherwise there was a risk of their becoming a charge on public relief funds.

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An International Congress and Exhibition of Social Economy will be held at Buenos Aires in Sept., 1924, under the auspices

**International  
Congress and  
Exhibition of  
Social Economy  
at Buenos Aires.**

of the "Museo Social Argentino," an unofficial institution in friendly relations with the Argentine Government. The Congress will deal, *inter alia*, with agricultural questions, *e.g.*, comparison of the importance of agriculture and commerce and

industry in various countries, organisation of agricultural credit and of international commerce in agricultural produce, etc.

Besides delegates representing national or municipal authorities anyone interested can, on payment of a fee, attend the Congress.

A copy of the preliminary programme can be seen at the Office of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1. Inquiries should be addressed to the "Museo Social Argentino," Maipú 126, Buenos Aires, Argentine Republic.

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## QUESTIONS IN PARLIAMENT.

**Grubbing of Hops.**—Sir A. Holbrook asked the Minister of Agriculture, in the House of Commons on the 4th July, whether he has received any request from hop growers in the country to cancel the proposed restriction of the 1923 hop crop; whether his attention has been called to the injury which would be inflicted by such restriction on a large number of growers whose whole capital is invested in the industry, as well as upon many branches of labour and trade associated therewith; and whether he will consider the desirability of cancelling the order for restriction?

Sir R. Sanders replied:—"I am aware that the call to restrict the 1923 hop crop has been very unwelcome to many hop growers who have been replanting the acreage which had been compulsorily grubbed in 1917, but I think that most growers recognise that no other course was possible, on consideration of

the fact that the consumption of beer has fallen far below that which was anticipated by those in closest touch with the trade. As I have already explained, should an average crop be produced and picked on the acreage under hops which obtained at the beginning of the year, a very large surplus over requirements would result. The Hop Controller would be unable to take this surplus from growers as he would have no prospect of selling it. Growers were therefore advised of the situation in January last in a notice issued from the Ministry, and they were recommended to arrange to restrict their production in the coming season. It was suggested that this might be undertaken this year as a temporary measure by a careful overhauling of the gardens, weeding out old and worn out plants, etc., and without resorting to permanent grubbing, until the position of the hop industry, which ultimately depends on the consumption of beer, could be more clearly foreseen. The answer to the last part of the question is therefore in the negative."

**Entertainments Tax on Agricultural Shows.**—In reply to a question asked by Mr. Lamb in the House of Commons on the 4th July, the Financial Secretary to the Treasury said that, under the clause which was added to the Finance Bill on the 2nd July, exemption from Entertainments Duty may be granted in respect of agricultural shows which, *inter alia*, consist solely of an exhibition of the products of agriculture, or of materials, machinery, appliances or foodstuffs used in the production of those products, or displays of skill by agricultural workers in work pertaining to agriculture, together with a band. Where an agricultural show includes exhibits outside those mentioned, the question whether exemption from Entertainments Duty can be granted depends upon whether such exhibits, if forming a separate exhibition, could have been exempted under any other provision of the law.

\* \* \* \* \*

**Foot-and-Mouth Disease.**—A further outbreak occurred at Skeffling on 29th June, the premises involved adjoining those on which the original outbreak of disease occurred on 20th June. The restrictions in this district have been relaxed from time to time, and are now applicable only to a small area immediately surrounding the infected premises.

**Bedfordshire.**—On 3rd July, a fresh centre of disease appeared amongst pigs, on premises at Stevington, some four miles from Bedford. The usual restrictions were applied in connection with this outbreak. Ten further outbreaks have since been confirmed on premises within a few miles of the first.

**Hampshire.**—On 25th July a new outbreak appeared at Alton, Hants. Further particulars will be given in next month's *Journal*.

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## REPLIES TO CORRESPONDENTS.

**Manurial Value of Feeding Stuffs.**—C. V. asks why the manurial value of  $P_2O_5$  in the note to the table on p. 167 of the *Journal* for May is charged at 4s. 6d. per unit, whereas on p. 169 the unit price of soluble phosphate is given as 2s. 3d.

*Reply:* The unit price in the footnote on p. 167 is for phosphoric acid ( $P_2O_5$ ). The unit prices on p. 169 are for total phosphates (as tricalcic phosphate). The unit price of insoluble phosphates is usually calculated (as



explained at the top of p. 11 of Leaflet No. 72) from the price per ton of steamed bone flour, after making allowance for 1 per cent. of nitrogen. Thus £6 17s. — 15s. 5d. = £6 1s. 7d. This divided by 60 gives approximately 2s. 0½d. per unit tricalcic phosphate and, multiplying 2s. 0½d. by 2·2 (see the rules for conversion on p. 3 of the leaflet) approximately 4s. 6d. per unit  $P_2O_5$ .

**Red Spider.**—E.M.G. asks whether Cox's Orange Pippin apple trees infested with Red Spider (specimens sent) are likely to be seriously damaged. Also for treatment to be applied.

*Reply:* The Red Spider you enclose appears to be the usual species (*Tetranychus pilosus*) found upon apples when growing in the open. It is seldom that this mite causes any serious damage, and although traces of their attack on the buds and leaves you send can be seen, judging from the small amount of material they could hardly be regarded as responsible for the major part of the injury.

There are signs of considerable caterpillar attack, Apple Blossom Weevil appears also to be present, and also Apple Sucker, while the margins of the young leaves are somewhat suggestive of weather injury. The orchard should therefore be examined rather carefully before you finally decide that the Red Spider is the pest to be tackled. If you come to this conclusion, then you might try one of the Red Spider washes indicated in the enclosed leaflet, or you might care to try the following, which appears to have been found exceptionally effective against this particular mite in the U.S.A.—Lime-sulphur in water, 1 per cent., with the addition of 6 lb. sulphur paste and 1 lb. resin fish-oil soap to each 100 gallons. The latter could with advantage be replaced by any good brand of potash soft soap.

**Wheat Bulb Fly.**—H.P. asked in April for the name of maggots found in the stems of wheat which was being destroyed and the remedy; also if rolling would be of service.

*Reply:* The wheat sent was found to be severely attacked by the Wheat Bulb Fly. The grubs were in all cases practically full grown, and if the sample was representative of the field, little further spread of the attack should take place.

Under these circumstances rolling would certainly be of value, but no further treatment was suggested. Wheat which had already escaped was not likely to become attacked, and it was only necessary to decide as to whether a sufficient plant was left on the field. If this was not the case, barley, which would not be attacked by the fly, could be sown, and a mixed crop taken.

In general, attacks by the Wheat Bulb Fly are found to be worse on land which has been fallowed or has been thinly covered by a crop during the latter half of the preceding summer.

In regard to treatment, apart from avoiding the sowing of wheat on land bare during July and August, the only measure which can be taken is to watch the wheat crops carefully so as to detect an attack in the early stage. An application of such a dressing as nitrate of soda will then be of value in assisting the crop to grow away from the attack, but it is of course necessary to detect the presence of the pest at an early stage.

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*New York Agricultural Experiment Station.*—Bull. 501:—Factors which Affect the Volatility of Nicotine from Insecticide Dusts. (34 pp.) Geneva, 1923. [63.295.]

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*U.S. Department of Agriculture.*—Bull. 973:—Milk Plant Operation. (45 pp.) Washington, 1923. [63.71(04); 63.713.]

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# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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SEPTEMBER, 1923.

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## NOTES FOR THE MONTH.

A THIRD Interim Report,\* dealing with meat, poultry and eggs, has now been issued by the Departmental Committee on Distribution and Prices of Agricultural Produce. The first and second reports, on milk and milk products and on fruit and vegetables respectively, were noticed in the *Journal* for May and July.

The Committee obtained a large amount of information from representatives of producers, distributors, and consumers, and, in addition, received from a great number of retailers detailed particulars of their general trading experience.

It is pointed out that unlike milk, fruit and vegetables, which normally reach the consumer in the same form as that in which they leave the farm, live stock are subjected to various processes, such as the slaughtering of the animals, the dressing and cutting up of the carcasses, and in the case of bacon, curing and smoking. These necessary processes add to the complexities and costs of distribution: they may also increase the number of intermediaries between the farm and the home.

It is plainly of importance to both producers and consumers that these intermediary operations should be carried out as efficiently and inexpensively as possible. It is further of importance that there should be a better understanding of the relationship of the agencies through which agricultural produce is distributed, and of the constituent elements in the price which the consumer pays. All engaged in live stock or poultry production should therefore purchase and study the Report. Diagrams show the different courses, sometimes direct, sometimes through the hands of middlemen, which meat, poultry and eggs may take in their journey from the farm to the home.

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\* The Report can be obtained through any bookseller or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. (Cmd. 1927, price 5s.).

In concluding its Report the Committee says, as regards meat:—

“We have investigated the conditions of the system of marketing and distributing meat in this country, and have set out the methods and costs in all their details so far as we have been able to ascertain them. It appears that, generally, the intermediaries concerned have increased their charges *pro rata* to their expenses, or to the change in the value of the meat with which they are dealing. We observe that retailers, however, have gone a little further and appear definitely to have increased their percentage margin of profit during recent years, and, as a class, to have improved their relative financial status in the community. We have also drawn attention to certain marketing, processing and distributive charges which might with advantage be revised.

We have indicated such improvements in the marketing of fat stock and meat as appear to us to be practical, and we earnestly commend these to the producers and distributors concerned. We are of opinion that meat traders, both wholesale and retail, should endeavour to give the best possible service in the distribution of home-produced meat, and, in particular, that they should endeavour to popularise the consumption of those cuts of the carcasses which are now in poor demand. We are further of opinion that retailers should make an effort to reduce the price of the home-produced article at an early date, especially if an effective demand for the poorer cuts can be successfully stimulated and the loss on them reduced. Producers can assist distributors, and themselves obtain considerable benefit, by marketing the type of animal which experience shows is best suited to the requirements of the retail trade.”

As regards poultry and eggs the Committee concludes its Report as follows:—“The outstanding feature of the poultry industry as we see it at the present time is the immense opportunity for expansion and development which awaits the home producer. Imports of both poultry and eggs are appreciably below their pre-war dimensions, and it should be his concern to see to it that they do not recover. To that end, though increased production and increased attention to breeding are essential, it is perhaps even more important that he should make an earnest effort to ensure that his produce reaches the market as efficiently and attractively packed, and as fresh as, if not fresher than, the imported article. There



can be little doubt that producers in those Continental countries which, owing to internal conditions, have temporarily ceased to export poultry produce to these shores will sooner or later seek to re-enter the British market. They can only be resisted by the home producer enlarging and consolidating his position."

\* \* \* \* \*

THE Agricultural Credits Act, which received the Royal Assent on 31st July, provides the following credit facilities for agriculturists:—

**The Agricultural Credits Act, 1923.** Section I empowers the Public Works Loan Commissioners to lend money to "approved associations" for the purpose of making advances on mortgages, also to lend money direct to borrowers, subject, in both cases, to certain conditions. The amount secured by the mortgage must be repayable within a period of 60 years, and must not exceed 75 per cent. of the value of the land, as ascertained to the satisfaction of the Public Works Loan Commissioners at the date when the advance by the Commissioners is made. In the case where the repayment extends over the full period of 60 years, the rate of interest and sinking fund will be approximately  $5\frac{1}{2}$  per cent. It should, however, be borne in mind that these facilities are limited to those farmers who agreed to purchase their holdings not earlier than the 5th day of April, 1917, nor later than the 27th day of June, 1921, and that the land comprised in the mortgage must be wholly or mainly agricultural land.

Agriculturists eligible for, and desirous of taking advantage of, the facilities offered by this Section, can do so by making formal application to the Farmers' Land Purchase Company, 1, Great George Street, Westminster, S.W.1, or to the Secretary, Public Works Loan Board, Old Jewry, E.C.2.

Under Section 2 of the Act, new facilities are placed in the hands of farmers, smallholders, allotment holders, and other agriculturists, for obtaining short-term loans, to meet such expenses as the purchase of seeds, fertilisers, feeding stuffs, breeding and other live stock, machinery and implements, and the erection of silos, Dutch barns, fencing, etc.

For this purpose the Minister of Agriculture and Fisheries is empowered to promote the formation of Agricultural Credit Societies, having for their object, or one of their objects, the carrying on of the business of combining the credit of their members, so as to enable them, with the assistance of advances

from the Minister, to make loans to their members, repayable within a period not exceeding 5 years, for such agricultural purposes as may be approved by the Minister.

The share capital of such societies will consist of an unlimited number of £1 shares, on which 5s. per share must be paid up on allotment. There is no limit to the number of shares that any member may hold, but every member must hold at least one share. Once a society has been formed and has been registered under the Industrial and Friendly Societies Acts, a member may make application to his society for a loan up to £5 for each £1 share held by him, provided that this sum shall not exceed one-tenth of the total share capital of the society for the time being issued. Thus it will be possible for a member who has taken 20 shares in a society, upon which he has paid up a total sum of £5, to obtain a loan of £100, for a period not exceeding 5 years.

The distinctive features of an Agricultural Credit Society such as is contemplated by the Act, are:—

(1) It rests on the fundamental principle of the mutual responsibility of its members;

(2) It is local—its members living within a comparatively small area, and being well known to each other;

(3) The liability of each member is limited to the full value of the shares in the society held by him;

(4) It has a right, subject to certain conditions, to borrow money from the State for the purpose of making loans to its members.

Although such societies are intended solely for the assistance of persons engaged in agriculture, membership is open to any person sufficiently interested in promoting the prosperity of local agriculture, to be willing to lend his capital and his credit for the purpose.

Those interested in the matter, or desirous of forming an Agricultural Credit Society, should communicate with the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Section III of the Act extends the facilities offered by the Improvement of Land Acts. The owners of agricultural estates, who wish to undertake permanent improvements such as the erection or extension of farm buildings and cottages, the making of roads, sewers, drains, etc., or the erection of silos, can obtain full particulars from the Lands Improvement Company, 1, Great George Street, Westminster, S.W.1, which operates under the Improvement of Land Acts.

\* \* \* \* \*



THE Ministry has published a brief summary of the courses provided at the Farm Institutes which have been established in England and Wales. There are now **Farm Institutes.** thirteen institutions of this type, of which eight have been started since the War. Last session the attendance was quite satisfactory, about 80 per cent. of the total accommodation being filled. The majority of the institutions provide winter courses in agriculture lasting for about 20 or 22 weeks, and in the summer, when the male students are required at home on the farm, dairying courses are provided for women. In a few cases, however, a year's course in agriculture, including the summer, is held. Horticulture and poultry-keeping figure in the curriculum. In all cases except one, farms typical of the district are attached to the Institutes, and serve to make the instruction of an essentially practical type.

The main purpose of the Farm Institute course is to enable a boy to leave his farm for the slack winter season of about six months, and during that time to become instructed in the broad scientific principles underlying the operations to which he is accustomed, or will have to be accustomed as time goes on. His interest is awakened, he is taught the why and the wherefore of many established customs which perhaps he had hitherto taken for granted, and generally he becomes imbued with a sense of the importance of "science with practice"—a condition which, in these days of progressive scientific farming, will be of enormous value to him in later years. It is well not to claim too much for the Farm Institute course. The object is not to provide training in science, or, on the other hand, practical experience in farming. The time available and the season at which the course is held preclude both these aims. It does not purport to give a complete training in agriculture, nor is it to be regarded as a stepping stone to the Agricultural College. It is primarily a "refresher," to take the farmer's boy out of the rut of established custom, and give him an interest in the unknown which will help him to take advantage in the future of all the immense stock of new knowledge which our scientists are day by day accumulating.

The Farm Institutes now in existence are situated in the counties of Cheshire, Cumberland and Westmorland, Essex, Hants, Herts, Lancashire, Northants, Somerset, Stafford, Suffolk, Carmarthen, Denbigh and Monmouth. A full list of

the courses which are being held at these Institutes will be published in a subsequent issue of the *Journal*.

\* \* \* \* \*

A PRELIMINARY statement of the Acreage under Crops and Grass, and Number of Live Stock in England and Wales in

**Crops and Live  
Stock in 1923.**

1923, compiled from the annual agricultural returns collected on 4th June, was issued by the Ministry on 4th August, and appears on pp. 567-570 of this issue of the *Journal*. The statement shows that, compared with last year, the arable area has fallen by 129,000 acres, while that of permanent grass has increased by 44,000 acres, and there is also an increase of 78,000 acres in the area of rough grazings. The reduction in the arable area is mainly accounted for by the corn, pulse, and potato crops, the decline under these three heads being 451,000 acres, 82,000 acres, and 94,000 acres, respectively. On the other hand there has been an increase of nearly 300,000 acres in the area of clover and rotation grasses, and a small increase in the area of roots.

The number of horses on agricultural holdings has fallen by 59,000, but other classes of live stock have all increased. The number of cows and heifers is the largest on record, and the numbers of ewes and sows kept for breeding also show substantial increases.

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AN account of the work accomplished in connection with drainage works for the relief of unemployment in 1922-3 is

**Drainage Works  
for the Relief  
of Unemployment,  
1923-24.**

given on p. 519 of this issue. In this connection it may be stated that the Government have now decided that, subject to the consent of Parliament, moneys shall be made available to enable drainage works for the relief of unemployment to be continued in the coming autumn and winter. The grants will be available only for combined schemes for the improvement of groups of holdings or properties, and not for field drainage work.

Drainage authorities, who have normal staff available, may proceed with the preparation of schemes, but no new staff for the purpose may be engaged, and no expenditure of any kind incurred, until the necessary sanction is afforded by the Ministry. No works may be started before 15th October, 1923.

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THE general index number of the prices of agricultural produce shows an increase from 51 per cent. above 1911-13 in June

**The Agricultural Index Number.**

to 53 per cent. above in July, this increase being mainly due to old potatoes being displaced by the new season's crop at a considerably higher price. The rise in the index number from this cause would have been greater but for decreases in the prices of fat stock.

The following table shows the percentage increase in each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ... ..	200	183	75	68
February ... ..	195	167	79	63
March ... ..	189	150	77	59
April ... ..	202	149	70	54
May ... ..	180	119	71	54
June ... ..	175	112	68	51
July ... ..	186	112	72	53
August ... ..	193	131	67	—
September ... ..	202	116	57	—
October ... ..	194	86	59	—
November ... ..	193	79	62	—
December ... ..	184	76	59	—

Wheat and oats were dearer by 4d. and 3d. per cwt. respectively than in June, but as these commodities usually advance in price at this season oats remain unchanged at 41 per cent. above pre-war while wheat has advanced one point. Barley was 3d. per cwt. cheaper in July, but owing to the average price in July of the years 1911-13 being higher than in June a fall of 5 points is recorded. The price of first early potatoes in July was nearly three times that of old main crop potatoes in June, and the index figure rose from 31 per cent. below the pre-war price to 66 per cent. above, as compared with 75 per cent. above in July, 1922. Hay was slightly cheaper in July, and with a decline of 4 points on the month was 38 per cent. above the average of July, 1911-13, or practically the same as in July of last year.

Fat cattle recorded a decline of 8d. per 14 lb. stone, this being relatively a much greater reduction than in the years 1911-13. and the increase of 45 per cent. above pre-war prices is 7 points lower than in the previous month. Fat pigs were in little demand during July owing to the exceptionally hot weather and prices declined sharply, the percentage increase over the pre-war years falling from 69 in June to 54 in July, a

drop of nearly 25 per cent. since January last. Average prices of fat sheep declined further and were lower than at any time since January, 1922; the index number fell 11 points to 72 per cent. above 1911-13.

Dairy cows advanced slightly in price, but as the increase was relatively less than in 1911-13 the percentage increase has declined 1 point. All descriptions of store stock were cheaper than in June, store pigs showing the greatest reduction, the decline amounting to 17 points on the month, while store sheep and store cattle declined by 5 and 3 points respectively. Store sheep and store swine were, however, still more than twice as dear as before the war.

The average contract price of milk is unchanged in London as very little surplus milk has been forwarded, but prices in Birmingham and Manchester have advanced slightly, and the average over all has increased from 53 per cent. in June to 57 per cent. above 1911-13, or slightly more than in July, 1922. Butter advanced 1½d. per lb., a relatively greater increase than in pre-war years, and at 37 per cent. for July was 4 points higher than in the preceding month. Eggs were also dearer, but as the increase in value was relatively less than before the war the index figure shows a reduction of 4 points on the month declining to 36 per cent. above the years 1911-13.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN  
THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922.		1923.				July
	July	Mar.	Apr.	May	June	July	
Wheat ...	53	27	31	37	38	39	39
Barley ...	49	8	11	16	17	12	12
Oats ...	55	36	39	42	41	41	41
Fat cattle ...	70	54	51	53	52	45	45
Fat sheep ...	107	94	100	103	83	72	72
Fat pigs ..	91	77	71	72	69	54	54
Dairy cows ...	64	58	55	50	50	49	49
Store cattle ...	39	31	29	33	31	28	28
Store sheep ...	108	92	92	98	114	109	109
Store pigs ...	115	136	131	126	130	113	113
Eggs...	80	55	37	43	40	36	36
Poultry ...	103	81	75	77	87	79	79
Milk ...	53	87	70	63	53	57	57
Butter ...	79	70	68	40	33	37	37
Cheese ...	50	95	92	42	44	54	54
Potatoes ...	75	—12*	—28*	—28*	—31*	66	66
Hay ...	37	42	40	41	42	38	38

\* Decrease.

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## AGRICULTURAL LANDOWNERS.

## I.

THE RT. HON. LORD ERNLE, M.V.O.

*The following pages are the substance of a Lecture on "Agricultural Landowners," given at the Summer Meeting of Vacation Students in the Examination Schools at Oxford on 9th August, 1923.*

THE subject given me is that of Agricultural Landowners. It bristles with controversies which arouse many prejudices. But we can, for a few minutes, treat agricultural landowners as neither saints nor ogres, but as ordinary persons—neither better nor worse than ourselves.

Men are land animals. Their interest in land is therefore almost universal. Most people can conduct their business without attracting public attention. Not so the landowner. His business is always under observation, because it affects the business and life of everyone. At work, at play, at home, we cannot escape the landowner. The result is that for centuries questions affecting the ownership of land have been burning. To-day they are still ablaze.

It is a common impression that agricultural landowners have grown rich while others remain poor, or that they are only sleeping partners in the industry, mere recent-chargers on their estates—that, in fact, they are bloated parasites. Are they bloated? Are they parasites?

**Stationary Character of Income from Farm Lands.**—During the last hundred years agricultural landowners have not grown richer. In net income they have become very much poorer. The growth of the gross national income of Great Britain is in striking contrast with the stationary character of the gross income of agricultural landowners. The following figures are only illustrations of these two facts. Without a complicated discussion they cannot be made strictly comparable. In 1800 the gross national income of Great Britain, both exempt and liable to income tax, was estimated at £190,000,000. In 1922 it was similarly estimated at £2,600,000,000. Now look at the gross income in Great Britain from agricultural land, farms and farm buildings, tithes, manors, fines on leases, and some sporting rights, in 1814 and in 1922. The former year is taken in preference to 1800, because the area of cultivated land had then become, under war pressure and fear of famine, more approximately as large as it is now. In 1814 the gross income

from agricultural land was  $42\frac{1}{2}$  millions; in 1922 it was  $43\frac{1}{2}$  millions, or practically the same. In 1814 it was rather more than one-fifth of the gross national income; in 1922 it was considerably less than one-fiftieth.

The stationary character of the gross income from agricultural land is the more remarkable, because, during this period, landowners have spent a vast amount of private capital on their estates. I am not considering the money spent in buying landed property, or even the money expended on the initial operations necessary to reclaim the land for cultivation. I am only speaking of the outlay of private capital in equipping the land with the farmhouses, farm buildings, cottages, fences (including gates and posts), drainage, water-supply, and farm roads, which are necessary to develop the productiveness of the soil. All this essential machinery of a farm is liable, like any other machinery, to wear and tear, and has to be kept in repair and renewed. The annual cost of this upkeep, including insurance and management, may be taken at a third of the gross rent.

**Rents.**—In a familiar often-quoted passage in his *Political Economy*, Mill points out that the rent of a farm includes two payments. One is payment for the use of the productive powers of the land; the other is payment of interest on the capital expended on that equipment which enables the farmer to use the land productively. The landlord, he says, is entitled to charge the ordinary interest on the value of the equipment, that is, he explains, on the cost of providing equipment as good as that then existing. It will be natural to expect that the payment of interest on capital, added to the payment for the use of the productive powers of the soil, would increase the gross income from agricultural land. It has not done so. The gross income has, as we have seen, remained stationary. What is the explanation?

It is the opinion of many experienced agriculturists that, after interest on capital at the low rate of  $3\frac{1}{2}$  per cent. has been paid, and the annual cost of upkeep has been met, all rent for the use of the land itself has been swept away by the fall in prices. The correctness of this opinion mainly depends on the amount of private capital which agricultural landowners have expended per acre on the existing equipment of the farms of this country.

This subject was discussed in 1907 with great care and ability by Mr. R. J. Thompson in a paper read before the Royal Statistical Society. He came to the



conclusion that in 1900 the average expenditure of private capital on the existing equipment of farms was £12 an acre; that interest should be charged at  $3\frac{1}{2}$  per cent., then the current rate at which the Government borrowed; that 35 per cent. should be deducted from the gross rent for repairs, insurance and management; and that, on those figures, out of every pound of rent 4s. 6d. represented payment for the use of land. More recently the Land Agents Society in 1919 prepared a Return from the actual figures of capital outlay. It relates to 9,000 acres, divided into 27 farms of different sizes, belonging to different owners, in different parts of the country. It shows that £146,000 was spent on equipping 9,000 acres, or an average of £16 an acre. The average net return to the landowner, after deducting from the gross rent the necessary outgoings for repairs, insurance and management, was  $3\frac{1}{2}$  per cent. on his capital, and nothing at all for the use of the productive powers of the land.

Neither of these inquiries fully reveals the true condition of affairs. The outlay on a farm varies to some extent with the purpose to which the land is put. A purely grazing farm, for instance, requires least expenditure. Still more important is the variation in outlay per acre caused by the different sizes of farms. £1,000 laid out on a 30-acre farm is £33 an acre; £2,000 spent on a 100-acre farm is £20 an acre; £7,000 spent on a 1,000-acre farm is £7 an acre. Practically all the figures quoted by Mr. Thompson relate to farms over 300 acres. In the Return of 1919 ten of the 27 farms exceed the 300-acre limit. But in actual fact, on the pre-war figures, out of the 435,886 holdings of England and Wales, 421,314 are holdings of 300 acres or under, and 14,572 are farms above 300 acres. That is to say, 96 per cent. of the farms belong to the type in which equipment is most expensive; only 4 per cent. are of the type which it is cheapest to equip. The average expenditure per acre is unduly lowered by the disproportionate number of examples of large farms on which both Mr. Thompson and the Return rely. Based on the actual sizes of holdings, the average outlay cannot be put at less than £20 per acre. If this is so, landowners may receive interest at  $3\frac{1}{2}$  per cent. on their capital outlay on equipment, and the cost of its upkeep, but nothing is paid for the use of the productive powers of the land.

Our system of agricultural landowner and tenant thus operates as a method of cheap agricultural credit, founded, not on State aid, but entirely on private capital. A lease is practically a loan of land equipped for cultivation at a low average rate of

interest on the capital expended in equipment. The farmer, who as tenant accepts the loan, is thus set free to use his own capital for the cultivation of the soil. The provision of the capital, running into several hundred million pounds, on which this system of cheap agricultural credit is founded, is one of the benefits which agricultural landowners confer on agriculture.

**Landowners' Example a Lead to Advance.**—Nor is it only their capital that agricultural landowners have contributed to the progress of the industry. They have by their example given a lead to advance. Medieval barons were indeed rarely interested in farming. War, military exercises and the chase were their chief occupations. There were exceptions. Edward II was a breeder of horses and an expert thatcher. An Earl of Berkeley, at or about the same time, is said to have attended all the markets of his neighbourhood with samples of his own corn, and fumbled in the recesses of his armour for his leathern bags of wheat, barley, or oats. But the foot of the lay owner rarely fattened the soil. The best farmers were the Churchmen, especially the monks. Two of the earliest treatises on farming were written in Norman French in the thirteenth century, one by a Bishop of Lincoln, another by a Dominican Friar.\* But the first English book was written by a Derbyshire landowner. In 1523 John Fitzherbert put his 40 years' experience into a *Book of Husbandry* which remained for more than a century the best and most practical work on English farming.

From the thirteenth century to the middle of the eighteenth, there was little general improvement in agriculture. If a steward of a manor in the reign of Henry III had visited a village farm in the days of George II, he would have found the same methods, the same implements, the same limited range of crops, the same quality of live stock. Probably he would have thought the farming more slovenly, and lamented the abandonment of more than one useful practice. Yet a number of new sources of agricultural wealth had been accumulated and tested by landowners. They had, in fact, collected the material and means for a proper rotation of varied cropping: they had also solved the problem of providing winter keep for live stock, and of supplying the country with fresh meat at Christmas instead of the smoked and salted beef or mutton which were formerly the staple diet of the nation.

In both the great periods of agricultural progress—1760-1820, and 1853-74—landowners gave the lead. In the first, they were pioneers of improved practices; in the second, they were the



readiest to adopt the discoveries of science. It was the union of practice with science, which in the "seventies" made English farming the model for foreign nations, and founded the world-wide reputation of English live stock.

In the disastrous period of the last 20 years of the nineteenth century, landowners also proved their value. They bore their full share of adversity. They saved thousands of farmers from bankruptcy, nursed them through bad times, and crippled themselves in the process. Few have now the means to help in the same way or to the same extent. Heavy taxation, pressing hardly on stationary gross incomes, has completed the impoverishment which the fall in prices began.

To have created an efficient system of agricultural credit, to have been leaders in progress and mainstays in adversity are achievements which can be fairly credited to agricultural landowners. No doubt their self-interest was a spur. But it is unreasonable to deny them a mixture of more generous motives. During the last century, the net income from agricultural land has dwindled, as compared with the increased financial resources of other classes in the country, enormously. This fact has a bearing on some of the charges often made against agricultural landowners in the administration of their estates.

**The Charge of Hostility to Small Holdings.**—One charge is that landowners are hostile to small holdings. Technically, holdings of from one acre to fifty acres are included in this class. Before the War, out of the 435,886 farmers in England and Wales 292,000 were small holders. More than 66 per cent. of the farms in England and Wales are of this size; less than 34 per cent. are above. This very considerable proportion of small holdings does not confirm the charge of general hostility. That agricultural landowners are cautious in creating them is true. They know that certain conditions both in the holding and the holder are essential to success. If all these conditions are present, a man who has an average share of good weather and stable prices ought to succeed. If any of the conditions are absent, or if the man has a run of bad seasons and irregular prices, he is almost certain to fail.

In the small holder's interest landowners are cautious. They are cautious also in their own. It is a matter of business. Unless they charge a very high rent, they lose money. The land must be good in quality and convenient of access to roads and markets. Often it is the very piece which lets a considerable area of moderate and indifferent land. Suppose that

a landowner desires to create a small holding of 30 acres consisting of some of the best land on a farm of 200 acres, let at £1 an acre all round. The tenant naturally asks a reduction of rent on the area which is left to him. The eye, as he says, has been picked out of his farm. The landowner is lucky if he escapes with a loss of £40 in rent. Can he recover it out of the small holding? In most cases he cannot. At present prices, the equipment of a small holding of 30 acres will cost £1,000, or £33 an acre. Assume that the rent is 30s. an acre, that is £45. From the gross rent must be deducted one-third for the upkeep. The net rent is therefore £30, or only 3 per cent. on the capital outlay and nothing for the land. The result is that the tenant-farmer is disgruntled and unsettled; that the small holder is aggrieved because he pays 10s. an acre more than the farmer over the hedge; and that, finally, the landowner is £10 a year out of pocket.

**The Charge of Wasting Land.**—Another charge is that of wasting land, firstly, by neglect to improve, and secondly, by excessive preservation of game. The total area of land in England and Wales to high-water mark, but excluding the acreage covered by lakes, rivers and canals, is 37,136,626 acres. The cultivated area under crops and grass, excluding gardens, is 26,025,000 acres. The area of commons, mountain, heath, moor, and other rough land used for grazing, amounts to 4,781,000 acres. Forests, woods and plantations occupy 1,884,000 acres. The remaining 4,445,000 acres are accounted for by buildings, gardens, railways, roads, and mountains and wastes not available for grazing. It is in the  $4\frac{3}{4}$  million acres of rough grazing that land is to be found which might be added to cultivation. Probably between 100,000 and 250,000 acres could be thus reclaimed. If expense were no consideration the area might be half a million acres.

In bringing land into cultivation there are two processes, each requiring some outlay of capital. The first is its preparation. Roots, for instance, have to be grubbed and stones removed; the land must be broken up, ploughed and probably marled: a portion must be sown for meadow or pasture. Almost all the cultivated land of the country has undergone this initial process. But the preparation took place too long ago to be taken into account in estimating the present capital outlay. Now, however, when the question is the expense of bringing new land into cultivation, it must be taken into account. It cannot be put at less than £5 an acre. To this must be added



the cost of equipment—that is to say, the farmhouse and out-buildings, the cottages, the fencing, including the gates and posts, the drainage, the water-supply, the farm-roads. What this will cost per acre largely depends on the size of the farms into which the newly reclaimed land is divided. Suppose that a landowner decides to reclaim a thousand acres of rough grazing, let at 1s. an acre, or £50 a year, and to do it as cheaply as possible. The initial cost of preparation is £5 an acre, or £5,000. At pre-war prices the cost of equipment for a thousand-acre farm cannot be put at less than £7,000, or £7 an acre. The capital outlay is therefore £12,000. Probably there will be no rent at all for several years. But assume that 12s. 6d. an acre is obtained from the first, or a gross rent of £625. From the gross rent must be deducted one-third for upkeep, insurance and management, say, £205. The net rent is therefore £420. But the landowner has lost the £50 a year rent for his rough grazing. He therefore only receives £370 a year on the transaction. If, as is almost certain, he has had to borrow the capital of £12,000, he pays for the loan at 5 per cent. interest £600 a year, and he receives from his new investment a net return of £370 a year. He loses £230 a year.

Go one step further, and suppose that the landowner is an enthusiast for small holdings, does what, on social grounds, we should all desire him to do, and lays out his thousand acres in 33 small holdings of 30 acres each. The initial cost of preparation is the same—£5,000; the equipment of the 33 holdings at £1,000 apiece is £33,000—making a total capital outlay of £38,000. At the best it is moderate land. Assume that the landowner lets at 25s. an acre, and gets it from the first. His gross rent is £1,250. From this has to be deducted the one-third for upkeep, say, £412. With 33 sets of farm buildings the cost of upkeep might probably be more. But that point may be waived. His net rent is therefore £838, or, if we deduct the £50 rent for rough grazing which he has lost, £788. But he has borrowed £38,000 at 5 per cent. He pays for his loan £1,900 a year, and receives from his new investment a net £788 a year. In other words he loses £1,112 a year. Comparatively poor men must set some limits to their philanthropy.

It is also said that agricultural landowners waste land and diminish food production by excessive preservation of winged game. That damage may be done to crops by winged game is not denied. and, where preservation is carried to excess, it

is a real evil. But even in pre-War days, the damage done was perhaps neither so great nor so general, as has been represented.

Bad farming often sheltered itself behind the alleged depredations of the pheasant. Nor does it seem, at first sight, probable that land which was worth cultivating was ever withdrawn from food production. Landowners are rarely rich enough to sacrifice a farming rent, however small, for a sporting rent of from 1s. to 3s. per acre.

Less bitterness against game preservation would be aroused, if landowners exercised their sporting rights themselves and did not let them to shooting tenants or syndicates. It is not merely that agricultural landowners themselves rarely preserve to excess, either from want of money, or respect for public opinion, or regard for their tenants. It is the intrusion of the commercial element into sport—the letting to strangers and the sale of the game—which chiefly outrages public opinion. Yet even this commercial element has advantages to the countryside. Many landowners can only afford to live in their country houses by the help of sporting rents. In other cases the sporting rights secure tenants for country houses that would otherwise stand empty. Those who live in the country know the loss to the whole neighbourhood when the big house is unoccupied. There is loss of employment and wages, loss of practice to professional men, loss of custom to local tradesmen, loss to the ratepayers of the rateable value of the empty house which must be made good elsewhere. There is loss also to farmers, for the rent of the house and the sporting rights often enable the landowner to maintain the efficient equipment of the farms which otherwise would deteriorate. Even if the house remains unoccupied, and only the sporting rights are let to shooting tenants, there are still advantages. Some of the money may go to the upkeep of the estate; keepers are employed who otherwise might be out of work; beaters earn money at a time when cash is scarce in rural districts. And sporting rights, thus severed and let, are a valuable rateable asset which diminishes the general burden of ratepayers. They pay the full and not the special agricultural rate; added to the rateable value of woodlands in their natural unimproved state, the rents substantially increase the assessment, and help to reduce the burden of the rates to everyone else.

*(To be concluded.)*



## POINTS OF THE HORSE.

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It is not the intention to discuss, in this article, the points of the various breeds of horses, but rather to try to define the good and bad points which may be seen in all classes of horses. In the space available we cannot hope to deal fully with a subject on which volumes have been written, but must confine our remarks to what seem to be the more important points. It is proposed to recognise only two types, the light (speed) horse, and the heavy (slow) draught horse, pointing out the few instances in which these two classes ought to differ.

To a great extent the economic value of a horse will depend on his durability, on his capacity to undergo severe strains in the work he has to do, whether in his speed-work, or in the moving of heavy loads, without breaking down and becoming useless for further work.

This durability will depend on his breeding or quality, on his conformation, and on his action. To judge these points correctly needs close observation and constant practice, and also some knowledge of the structure of the animal's body is useful. Many good judges seem to know intuitively what is the best shape, and do so without any knowledge of anatomy, but the man who has this knowledge will become proficient in a much shorter time.

**The Framework.**—The horse's framework or skeleton is composed of a large number of bones connected by cartilage and ligaments. Attached to the bones are the muscles which supply the motive power under the control of the nervous system. The bones form three classes of levers, to which the muscles supply the power and the joints form the fulcra. Many muscles act on distant parts of the framework, to which they are attached by long tendons or sinews. This arrangement gives lightness and elegance to the lower part of the extremities.

To a considerable extent the bones of the skeleton give shape to the body, but not entirely so: for example, in the neck the shape depends on the muscular development. If we compare a living animal with an illustration of the skeleton (A) this fact is at once seen to be true. Again, the hind-quarters have a bony framework, but their shape largely depends upon the great muscles covering the bones of this region.

A glance at a well-developed horse will show a marked difference in the muscular development of the hind extremities compared with the fore extremities.

The hind limbs supply the propelling power, which enables a draught horse to move a heavy load, a hunter to fling himself (and his rider) over a high or a wide obstacle, and a race-horse to travel at high speed. To do this, the muscular development of the hind parts must be great, while the fore extremities, having only to support the weight of the body (of which they seem to carry more than a fair share), take but a small part in propulsion. For this work the fore limbs need far less muscular power. If we assume that the hind legs support the weight of the posterior half of the trunk, it will be seen that, in addition to carrying the anterior part, the fore limbs have to support the long neck, to the end of which is attached a heavy head. These facts are borne out by the greater muscular development of the hind extremities, and also by the very different modes of attachment to the trunk of the fore and hind extremities.

In the latter, the top bones of the limbs, the ossa innominata or pelvic bones, are firmly attached by a fixed joint, to the back bone in the sacral region. An examination of the skeleton will show how carefully nature has provided for firmness and strength in this region to withstand the enormous strain when pulling a load, or leaping or galloping.

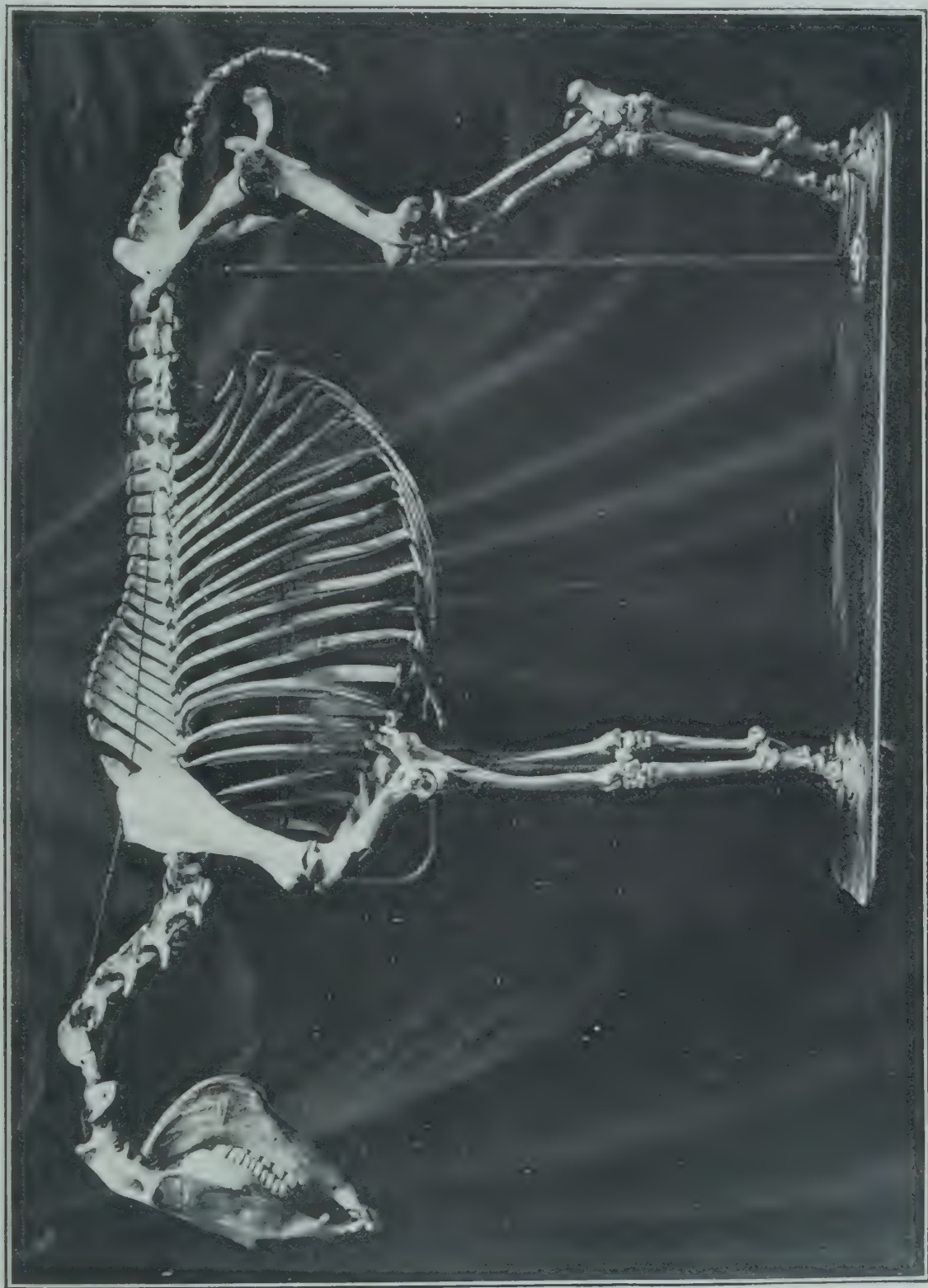
When we examine the fore-extremity we notice the absence of the great powerful muscles supplied to the hind extremity, and we find that the fore-limb is only attached to the front part of the trunk by muscles, and that there is no fixed immovable joint like that in the hind leg. If we stand in front of the horse and direct our attention to the anterior part of the trunk, we see that it is placed between the shoulders, to which it is attached by muscles, which suspend it (the trunk) as a man's body is supported in a hammock.

These anatomical facts confirm the view that the hind limbs are used for propulsion, while the fore-limbs chiefly support the weight of the body.

The fact that the fore-legs have to support so much weight will explain the reason why they wear out more quickly than the hind parts do.

In carrying a man in the saddle it has been estimated that the horse's fore-legs take 66 per cent. and the hind-legs only 34 per cent. of the man's whole weight. In going downhill





A.—Skeleton of Horse.





a still greater portion of the weight will be thrown on the fore-legs.

The movements of the limbs in walking, trotting, galloping, etc., are exceedingly complex, and are brought about by different groups of muscles, contracting and relaxing in proper sequence, and all working together harmoniously. This co-ordination of the various groups of muscles, taking part in any movement, is fortunately not controlled by the animal's will, but is regulated by a special part of the brain (cerebellum) set apart for this work.

Before dealing with quality, shape and action, it is necessary to mention the lubricating system of the body, by which the movements of the limbs are made smooth and easy. Each joint is surrounded by a capsular ligament forming a bag enclosing the ends of the bones. This bag is lined by a synovial membrane which secretes the lubricating fluid, synovia or joint oil. Wherever a tendon plays over a bone, or through a fibrous sheath, synovial membranes are arranged to provide the lubricating fluid and so to prevent friction. Without this lubricating system, the rapid movements of the limbs would soon become impossible, and the wearing parts would be quickly destroyed by friction.

**Quality or Breeding.**—Horses show their breeding in their bones, skin and hair. The bones of a well-bred horse are denser, harder, more ivory-like, than those of an under-bred animal, in which they are found to be softer, more spongy, and far less durable.

The skin should be thin and elastic and covered with fine soft hair, and in those heavy breeds in which long hair or "feather" grows on the lower part of the legs, it should be fine, straight and silky, not coarse or inclined to curl. A coarse thick skin and coarse thick hair in a draught horse will indicate want of breeding and point to bone of a poor quality.

Horses, however, also show quality in the size and shape of the head. It has been written (The Druid): "Had I to choose a hunter by seeing one point only, it should be his head, for I never knew one with a small clean intelligent face and prominent eyes to be bad" (B. See illustration.)

Horses of all classes show their quality by their heads, which should be small, wide across the forehead, with large kindly eyes (a sign also of good temper), small pointed ears, a wide space between the outer corner of the eye and the angle of the lower jaw, large open nostrils, and plenty of space between the

branches of the bottom jaw to give room for the upper part of the windpipe (larynx). The nostrils must be thin and flexible and capable of great distension. The horse is unable to breathe through his mouth owing to the great length of the hanging soft palate, and he therefore needs to have nostrils capable of distension to admit sufficient air during exertion.

In the low-bred horse the head is large and coarse and unshapely, with large ears, a narrow forehead and small eyes and nostrils.

Quality and good breeding denote endurance. Dick Christian has said, in speaking of the thoroughbred hunter: "I never heard of a great thing yet, but it was done by a thoroughbred horse."

Breeding tells, and it is wise for the horseman to look for these indications of quality in whatever class of horse he requires.

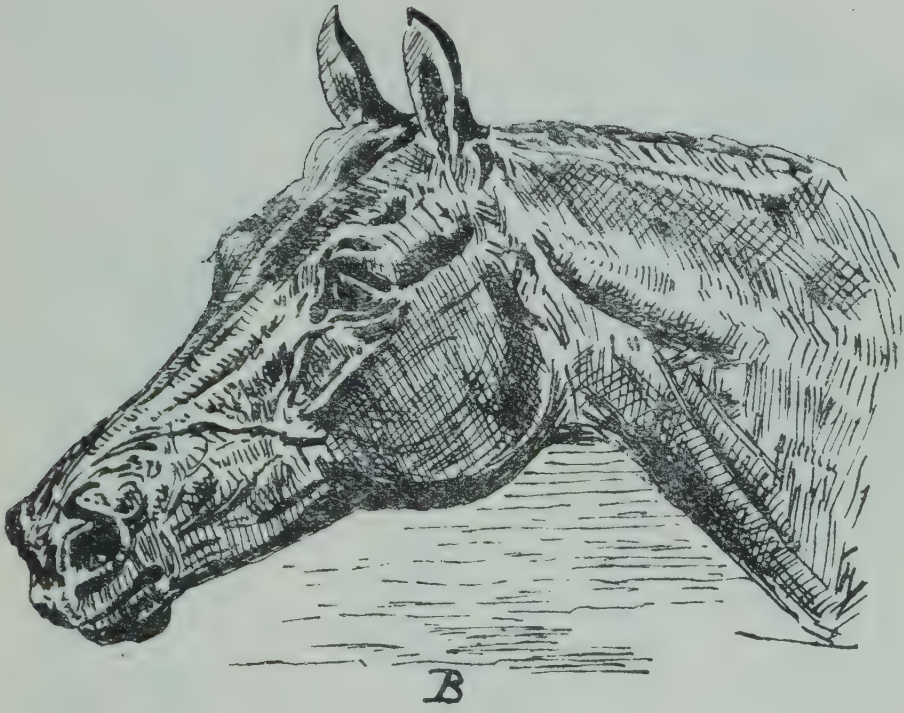
**Conformation.**—As indicated above the horse's locomotor apparatus contains a highly organised collection of bones and joints, muscles and tendons, and an intricate set of levers, all working harmoniously together, without waste of power and without undue friction.

This harmony will depend greatly on the true shape of the body and limbs, and it must now be our task to show what is to be regarded as the correct conformation. It is necessary first to take a general survey of the animal as a whole before making any detailed examination of the several parts, head, neck, trunk and limbs.

When viewed from a short distance the well-proportioned horse should deceive the eye; he should seem much smaller than he afterwards proves to be on closer acquaintance. The most remarkable instance of this, in our experience, occurred when inspecting a high-priced weight-carrying hunter. When the door of the loose-box was opened our first impression was that we were looking at a "mere cob," but on standing at his shoulder the "mere cob" proved to be over seventeen hands high! This deceptive appearance is an excellent point in a horse's favour.

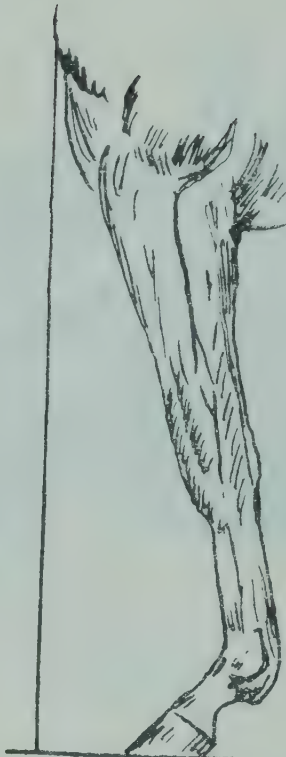
*The Head.*—Still standing at a distance the shape of the head should be noted, and the way it is attached to the neck. The head should be carried gracefully and should move freely on the neck without fullness or heaviness at the junction of head and neck (B).







*E*



*F*



*G*



*H*



*I*



*J*





K



L



M



N



O



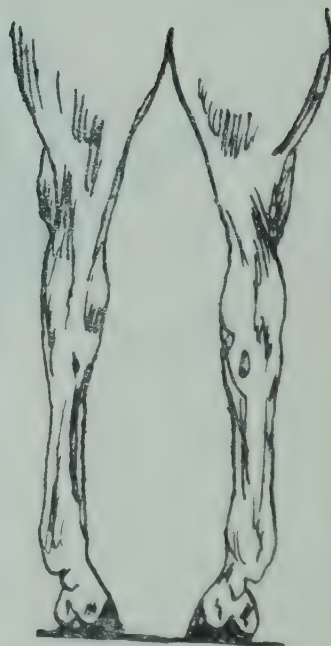
P



Q



R



S



*The neck* should be sufficiently long and muscular, with a well defined wind-pipe in front, and nicely arched at its upper border, and *without* a heavy crest. The crest is formed by a mass of fat surrounding the long elastic ligament of the neck, which helps to support the weight of the head. A thick heavy crest only adds to the weight to be carried by the fore-legs.

In the draught horse the neck should be muscular, of medium length and thickness, and unencumbered with fat.

In all classes the ewe-neck with the badly set-on head is to be avoided.

*The chest*, seen from the front, should be narrow in the light speed horse, but broad and muscular for the heavy draught horse. The space between the fore-legs in the former, should allow the open hand to lie easily under the breast bone, but in the latter the breast needs to be wide and well muscled, and the fore-legs sufficiently separated. Again, viewed from the side the chest should be deep from above downwards rather than broad from side to side. The deep oval chest gives a better girth and a greater lung capacity than the broad round chest. Also the deep chest gives freer play for the shoulders, and is evidence of good staying power. A broad chest, with too much space between the fore-legs, renders free smooth action impossible.

In the speed horse the neck seems to blend imperceptibly with the shoulder, but in the draught horse there is a sufficiently deep hollow at the junction of neck and shoulder into which the collar may fit comfortably.

*The ribs* behind the shoulders should be sufficiently arched to form an oval chest, and the posterior ribs should be sufficiently long to prevent an appearance of "lightness in the flank." The last rib should be about a hand's breadth in front of the hip bone to give a "well-ribbed up" appearance. This shortness of the space between the last rib and the hip bone may be due, either to the presence of an extra or "floating" rib, or to the loin region containing only five vertebræ.

Where a horse is "badly-ribbed up" there is no floating rib, and the number of lumbar vertebræ is often increased to six instead of five.

The "well-ribbed up" horse is generally a good doer, while the "badly-ribbed up" animal is often a delicate feeder, difficult to keep in good condition and very liable to scour.

*The Withers.*—Turning our attention next to the upper line of the body, the withers should be prominent and should rise up well above the shoulder blades. The withers should be thin in the speed horse, but much thicker and more muscular in the draught horse. Low withers are inadmissible except in the immature animal. The withers are formed by the long superior spinous processes or projections of the first few dorsal vertebræ, and the further back the long processes extend the shorter the back will appear. Between the withers and the croup the spinous processes are all of equal length.

*The Back.*—Although anatomically the withers are part of the dorsal region or back, the horseman recognises two regions, first the withers, then the back. The back should be straight. A hollow back must be regarded as a sign of weakness. In all old horses, there is a tendency for the back to become hollow. The muscles on either side of the back-bone should be well developed and fill up the angle between the ribs and the vertebræ.

*The loins* lie between the back and the croup and are formed by the lumbar vertebræ, five or six in number. When six bones are present the loins appear too long, unless well covered with muscle, and the space between the last rib and the hip bone too wide. The loins should be broad, muscular and flat, and should continue the line of the back towards the croup. If the line rises from the back to the croup the horse will have a “roach-backed” appearance. It is important that the upper line of the body from the withers to the croup should give an impression of shortness when compared with the under line from the elbow to the stifle.

Although *the quarters* belong to the hind extremities, it is convenient here to continue the survey of the upper line backwards to the buttocks. The quarters should be well shaped and pleasing to the eye, the central line being slightly convex. The hip bones should be wide, but not sufficiently prominent to warrant the term “ragged.” The tail should be set on “high” and be carried with distinction (K). We shall refer again to the quarters in describing the hind extremities.

*The Under Line.*—Turning our attention to the under line of the body, when the shoulders are good, the chest deep and the posterior ribs of sufficient length, the under line will appear long, and nearly parallel with the surface of the ground, and the horse is said to “stand over a lot of ground.” The horse with upright shoulders, badly placed fore-legs, and a



round barrel, will look "leggy" and show a "lot of daylight under him."

In the majority of horses the length from the point of the shoulder to the buttock is about equal to the height at the withers, so that the body and limbs (excluding the neck and head) form a square. This rule will hold good for the "long low" horse as well as for the "leggy" looking animal with a "lot of daylight under him."

The reason for this different appearance is that the former has good oblique shoulders, a short back and a long under line; in the latter the shoulders are upright, making the back look longer, while the under line is defective owing to the backward position of the fore-legs, the shortness of the posterior ribs and the long space between the last rib and the hip bone. It is the true conformation of the body which is deceptive making the top line appear short and giving the under line length, but when the shape is wrong the opposite effect is produced, a long back and a short under line producing a high "leggy" appearance. If two horses were measured for length and height, although one looked "long and low" and the other "leggy and light in the barrel," they would both be found to approximate the squareness of the body and limbs mentioned above.

*The Fore Limbs.*—Next, viewing the fore-leg from the side, we should find a long oblique shoulder-blade, sloping upwards and backwards from the shoulder-joint. This appearance of a good sloping shoulder is aided by the correct position of the second bone, the humerus, which should form a wide angle with the scapula, and should be placed in a more or less perpendicular position between the shoulder-joint and the elbow (C). This brings the fore-arms and knees well forward and adds to the length of the under line of the body.

If, however, the humerus is more horizontally placed (D) the fore-arm and knee will be more backward under the body, and will give a shorter under line. This latter position of the humerus goes with upright shoulders, while the more perpendicular humerus is seen with the good sloping shoulder. Well-shaped shoulders are essential in all classes of horses, giving smooth free action to the fore-limbs, but in the draught horse some authorities maintain that a more upright shoulder is not only admissible, but even an advantage in giving greater power in collar work. This may be true; but to-day a well-

made draught horse is expected to be capable not only of walking well, but of trotting with good free action, and for this the sloping shoulder is essential. The shoulder-blade should be well covered with muscle in the speed horse, and still more so in the heavy horse.

To test the obliquity of the shoulder, an imaginary line may be drawn upwards from the centre of the fore-arm and should pass just behind the shoulder-joint, so that the major portion of the scapula is behind such a perpendicular line (C). The large and powerful muscle which fills the angle formed by the scapula and humerus should be well developed, plump and firm.

The fore-arm, between the elbow and the knee, should be long, broad and muscular above, but narrowing towards the knee. A weak thin fore-arm is a great disadvantage in both speed and draught horses. The knee should be large, flat in front, but with a strong projection at the back formed by a bone, the trapezium. This bone gives attachment to important muscles of the fore-arm, and also forms a groove between it and the main part of the joint, through which pass two of the flexor tendons. If the trapezium is small and placed too close to the main joint, the tendons have not sufficient room for free play and are cramped in their action. Below the knee, the cannon bone should be short and strong, and the leg broad from front to back. This will give the necessary "good girth" below the knee, and the "flatness of bone" as it is termed in horse-man's parlance. The width of the leg below the knee depends upon the position of the three back-sinews which pass down behind the cannon bone. These three sinews should be clearly defined and stand out well from the cannon bone, and from each other. It is *this* which gives "good girth" and "flatness" so much praised. When the back sinews are packed closely to one another and to the back of the cannon bone, the leg feels round instead of flat, the girth is small, and there is a "tied in" appearance below the knee. Although "flatness of bone" below the knee is often spoken of, the term is incorrect, as the cannon bone is oval from side to side and narrowest from front to back, and cannot give an appearance of "flat bone," which is due, as stated above, to the position of the back-sinews in relation to the cannon bone.

The fetlock should be sufficiently large and strong, with well-developed sessamoid bones at the back. These two small bones are attached behind the cannon bone at its lower end,



and together form a groove over which two flexor tendons play freely.

From the fetlock, the pastern slopes downwards and forwards to meet the hoof at the coronet. This slope of the pastern varies considerably in different horses, but should always correspond to the slope of the front of the hoof, to which it should be parallel.

The hoof should slope upwards and backwards to the coronet at an angle of about  $55^{\circ}$ , and the slope at the heels should be parallel to that at the toe, and the heels about half the height of the front of the hoof. One frequently reads the absurd statement that the proper slope of the front of the hoof is at an angle of  $45^{\circ}$ . A single glance at a drawing of a hoof at this angle will show its impossibility. On raising the foot and examining its under surface, it should be almost circular in shape, with wide open heels, a concave sole and a good strong frog. There is nothing more true than the old saying, "no foot, no horse." However good his other parts may be, a horse will be of little economic value if his feet are faulty.

Lastly, before viewing the fore-legs from the front we should drop an imaginary line from the point of the shoulder to the ground (E). If the leg is properly placed and well shaped, the line should touch the ground slightly in front of the toe. In a horse with the "knees back" the line will fall several inches in front of the toe (F). In viewing the fore-legs from the front the fore-arms should be long and muscular, the knees broad and strong, and the fetlocks large and well developed. Large joints, in proper proportion to a horse's build, will give a distribution of the weight over a larger surface, and will also give promise of well-developed muscles and stout tendons.

The fore-legs should be perfectly straight, so that an imaginary line, drawn from the centre of the fore-arm (front) to the ground, should divide the knee, cannon bone, fetlock, pastern and hoof into two equal parts (G). Very many horses do not come up to this standard, some being "calf-kneed" (H), others "pentoed" (I), while many have legs turned out from the fetlock (J). Horses having such defects cannot have true action and will not be durable.

*Hind Limbs.*—Next, turning our attention to the hind extremity as seen from the side, the quarters should be well shaped and lengthy from the croup to the buttocks (K). The shape of the quarters depends partly on the bones forming the

pelvic cavity and partly on the great muscles clothing the bones. The sacral vertebræ, which follow after the loin bones, form the roof of this cavity, and should continue in almost the same horizontal line as that of the back and loin, and the first tail bones, which come after the sacrum should continue the line backwards. In such long level quarters the tail will be "set on high up," but where the sacrum and early tail bones droop downwards the quarters will have the shape known as "goose-rumped," and the tail will be "set on low down" (I). Many goose-rumped horses, however, make excellent hunters.

The muscular development of the quarters and thighs should be good and in keeping with the conformation of the fore-hand. Too much muscle behind with a light fore-hand is not good.

The thigh bone (femur) slopes downwards and forwards from the hip joint to the stifle, and should be well covered with powerful muscles. From the stifle to the hock the bone (tibia) slopes downwards and backwards. This part of the limb corresponds to the fore-arm and should be long and muscular. Length of the gaskin and fore-arm is essential, while the parts below the hock and knee need to be short.

The hock (tarsus or ankle) is perhaps the most important joint in the limbs. It should be strongly built, with a good length of the bone at the back forming the point of the hock (calcis). To the calcis are attached tendons belonging to the powerful muscles of the back of the tibia, and other tendons also play over this bone in passing down the leg to the foot. The main hock-joint, in which there is the greatest movement, is between the end of the tibia and a bone of the hock known as the astragalus. The articulatory ridges on this bone run downwards and forwards and outwards and play an important part in the action of both hock and stifle. Sir F. Smith, in writing of the hock, attributes the "well-marked stifle action, particularly well seen in trotters" to the screw-like action produced by the astragalus. In addition to the main joint there are three minor joints in which the movement is slight and gliding. When viewed sideways the hock should be broad both above and below, and the point of the hock (os calcis) should stand out prominently, and well clear of the lower end of the tibia. On looking at the hock from the front it should have a bold clearly-defined outline, and on the inner surface the small bones forming the gliding joints should be strongly developed, and we should be able to feel, between the bones,



the three grooves which mark the position of the minor joints. A weak hock is broad above but small and narrow at its lower part, from whatever point it is viewed.

An imaginary line dropped from the buttock should touch the point of the hock and the posterior margin of the leg, as far as the fetlock and then drop to the ground (M). If the hock is too much curved ("sickle-hock"), the line will touch the point of the hock but no other part of the leg (N). If the leg inclines backwards from the hock, the same line will strike the ground near to the toe (O). If the hock is too straight (P) it will be more likely to be injured by concussion, and in the straight hock the os calcis has a cramped appearance. Below the hock the limb follows the same conformation as the fore-leg below the knee, but the pastern and hoof are more upright, and the hoof is longer from toe to heel, is oval in shape, and has a more deeply-concave sole.

When seen from behind, the quarters should be equal both in regard to the position of the hips and in muscular development; any inequality denotes some defect. The muscles clothing the inside of the thigh should be plump and firm and round. Any deficiency of muscle here will give a "split up" appearance between the thighs.

The hind legs should be straight (Q) with the hocks neither too close together, nor too wide apart, and should not turn outwards from the hocks (cow-hocked) (R), nor turn inwards (pentoed) (S).

**Action.**—Good action generally depends on good conformation, and a badly-shaped horse cannot be a good mover.

To judge action the observer should see the horse move at the walk, trot and gallop (if the horse is to be used for work at this pace) both going away and coming towards him and also in passing. In passing it will be seen whether the horse has well-balanced equal action before and behind. The walk should be light and active, and the feet lifted high enough to clear any ordinary inequalities in the road surface. The fore-legs should be extended well forwards before the feet touch the ground and the hind-legs must be brought well under the body so that the hind-hoofs at least cover the impressions made by the fore-hoofs.

A good active walker will usually have good action in all his paces, while a shuffling, clumsy, heavy walker will not. In the walk, the fore and hind-legs should be carried directly forward in a straight line, without any faults such as

“dishing” in front, or “twisting” the hocks outwards and the toes inwards.

In the trot the hind-legs must be carried well forward under the body, and the fore-legs carried equally to the front, without too much knee action, but in any case the action before and behind should be equal and well balanced.

High knee action with indifferent hock action is often seen, but is very faulty.

From an economic point of view, excessively high action must be condemned, however beautiful it may look in the show ring or in the park. Such action causes too much concussion and rapid wear of the limbs. A moderate all-round action is preferable, as more durable. In the trot, as in the walk, the action should be straightforward, without any “dishing” in front or “twisting” behind. In the gallop the action should be free, smooth and low, and without any high jerky bounding movement such as may be seen in a horse that is not a galloper.

In the true galloper the impression conveyed to the observer is that of a beautiful, well-oiled piece of machinery, working with faultless smoothness and precision, and at high speed.

True action means that the work is done without loss of power and with the minimum of effort, and consequently with the least amount of wear and tear.

*Acknowledgments*:—Badminton Library ; Smith's Veterinary Physiology ; Hayes, Points of the Horse ; The Veterinary Adviser, Leighton ; Horses and Stables, Fitz-Wygram ; Judging Livestock, Craig ; Journal of Royal Agricultural Society.

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## PIG-KEEPING.

### I.

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*The Farmer's Aim—Pork, Bacon; Scale of Business; Capital Required; General Management; Breeding of Pedigree Pigs; Duties of the Pigman; Breeds, and Suitability for the Particular Business adopted; Pure v. Cross-bred Pigs.*

IN 1922 the pig population of England and Wales was returned as 2,298,936; in 1872 the number was 2,586,000. In the intervening 50 years the demand for pig products in this country had steadily increased, but this demand was not accompanied by a corresponding increase in the numbers of our pigs, with the result that our imports of bacon rose from 2,001,855 cwt. in 1872 to 5,932,152 cwt. in 1922. Imports of hams, lard and pork showed similar advances. The imports figure for pork in 1922 was 757,606 cwt., while the total weight of pig products imported in 1922 was 10,422,320 cwt., representing a value of £55,306,027.

In 1881, Denmark's pig population was just over 500,000; at present the figure is in the neighbourhood of five times this number. While those engaged in British agriculture failed to keep pace with the growing demand for the products of the pig, Danish agriculturists and bacon curers set themselves the task of finding out exactly what the British consumer wanted in the way of bacon, and having learned this, they then proceeded to cater for the British market. The result is that to-day Danish bacon holds a strong position in the favour of the British housewife, and although it should not be impossible, it will not be a speedy or easy process to displace it. If British agriculture is going to succeed ultimately in holding the British market against the foreigner in this respect, it must supply what the bacon curer and the consumer want. If this is done there is no reason why the whole of British requirements in pig products should not be produced within the British Isles.

Certain reasons have been put forward from time to time to explain why farmers have not developed the pig side of farming. Possibly the most important of these reasons has been the periodical fluctuations in the price of pigs. It is,

however, those breeders and feeders who have pursued a steady policy, and who have not jumped in and out of pig-keeping as the prices went up and down that have suffered least from the changes in market values. It is possible that fluctuations may occur again, but the increased operations of the home bacon factories should help considerably to stabilise prices. In any case a consistent policy of pig-keeping should be the safest course.

The prevalence of Swine Fever and Swine Erysipelas, together with the pressure of Swine Fever regulations, have also restricted development.

Inquiries which have been made recently with regard to the present position of the pig trade, have tended to show that the bacon factories already established in the country are able to deal with the present supply of pigs, and that some of them experience difficulty in obtaining the required quantities. Complaints are made that the pigs supplied, even when adequate in numbers, may be unsuitable in conformation, weight and feeding. Further, there is an increasing demand for pork which tends to reduce the supply of pigs for bacon.

In addition to the broader economic argument for pig-keeping on an increased scale, one must bear in mind certain other considerations in favour of the pig. The sow's prolificacy in rearing 16 pigs in a year compares favourably with the ewe or cow. The pig is invaluable in utilising glut products, for example, potatoes and barley as in the winter of 1922-23, and whey on cheese-making farms; and further, the pig is the most economical manufacturer of meat, putting on 1 lb. of live weight increase with less food than any other farm animal.

**The Farmer's Aim.**—In starting or reconstructing his pig-keeping the farmer should consider his market, and whether he is to cater for the fresh pork or bacon trade, or both. It is usual for good pork pigs to make a higher price per pound than bacon pigs, and to sell pigs for pork has proved, lately, a more profitable line of business than to supply pigs for bacon. On the other hand the pork demand is more subject to seasonal and other fluctuations. Bacon prices are steadier. Pork production is more speculative, but offers greater chances of profit.

The demand of the present day is for small joints of good quality pork and for mild cured bacon produced by young pigs.



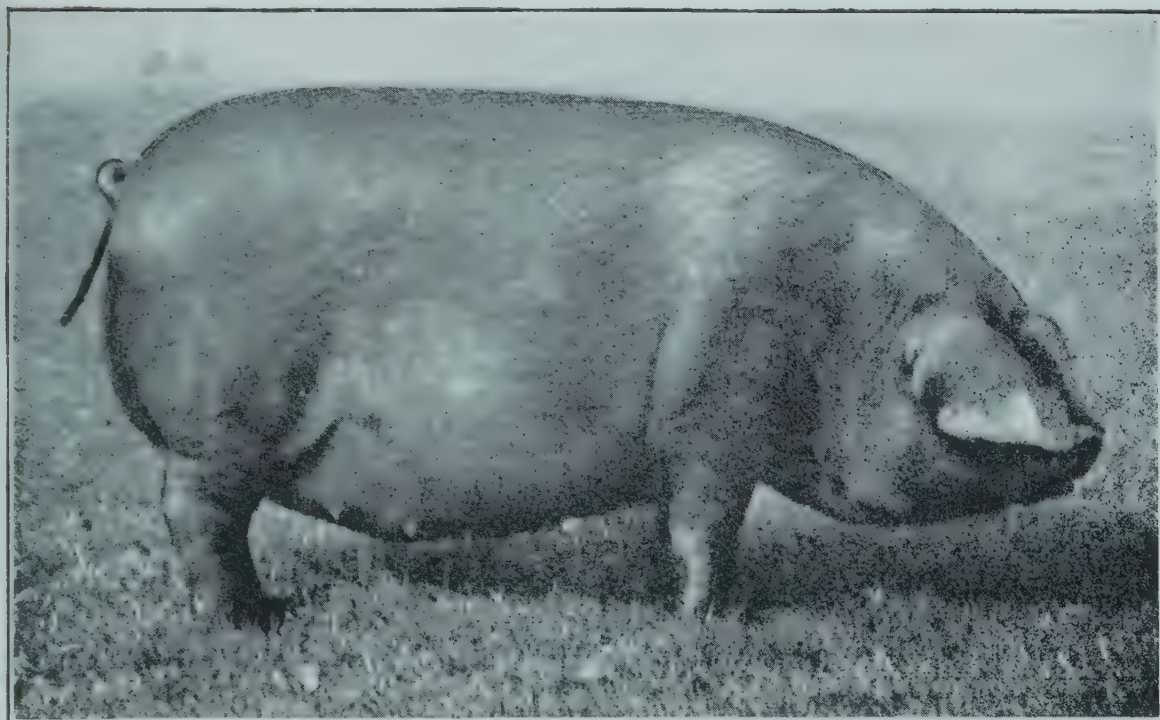


FIG. 1.—Large Black Gilt—Molly of Moulton 2nd—a dual purpose type of female pig which could be mated to breed bacon or pork pigs.

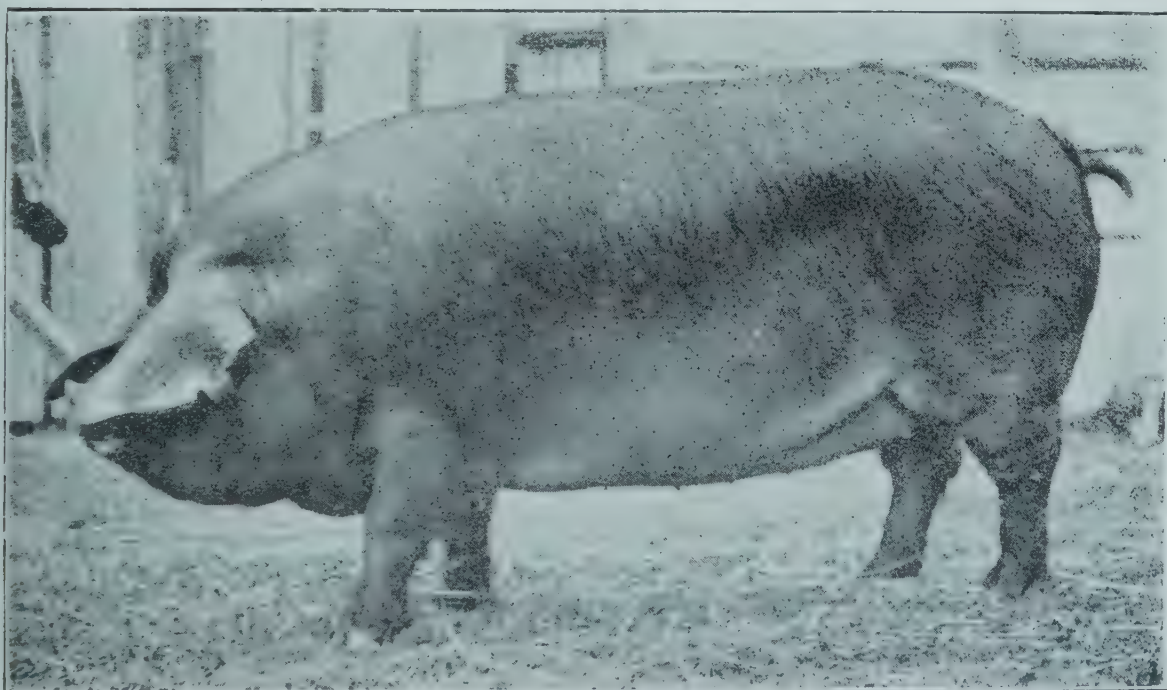


FIG. 2.—Large Black Sow—Cornwood Lass 67th—a typical bacon dam.



FIG. 3.—Large White Boar—Worsley Jay 35th—a typical bacon sire.



FIG. 4.—Middle White Boar—Shrewsbury—a typical dual purpose sire, suitable for breeding pigs either for pork or bacon.



It is for this class of pork and bacon that the consumer will pay highest prices.

The size and degree of fatness, of joints of pork wanted, vary in different districts. The type of porker most popular on Smithfield market is one of about 90 to 100 lb. live weight and about 60 lb. dead weight at 4-5 months old, but the pork pig which is in most general demand throughout the country is one weighing 120-140 lb. live weight or about 100 lb. dead weight at about 5-6 months old. In certain manufacturing centres in the North Midlands and Black Country the "fat pork" pig is wanted: that is, a pig weighing 240-300 lb. live weight and about 180-220 lb. dead weight. The demand for "fat pork" is, however, strictly limited, and very frequently there is an over supply of fat heavy pigs. When such a surplus occurs these pigs make poor prices, actually about the same as fat sows, and they are then commonly used for sausage-making. Generally speaking the smaller the pig the higher the price paid per pound, and the heavier the pig the lower the price per pound.

Bacon curers appear to be agreed that the ideal type of pig for bacon should weigh from 200-220 lb. live weight and from 140-170 lb. dead weight, and should be fit to kill at 6-7 months old.

Thus we see that with the exception of the "fat pork" type, pigs should be ready for killing at 4 to 7 months old. Possibly the largest and keenest demand is for the pork pig of 5 score dead weight. The 3 score pork pig is required almost exclusively for the London market. The fat pork trade is the least attractive, since it is limited in demand, confined to particular areas and frequently over-supplied, more particularly because the older-fashioned feeders have not yet realised that the requirements of consumers have changed and that young, early-maturing, good quality pigs are what is now generally wanted.

It should be recognised that the cost of production of pork is higher in older than in young pigs. Professor Henry has given certain figures taken from a large number of experiments conducted in the United States, which show that to produce 100 lb. of live weight increase, pigs weighing 50-100 lb. live weight required 400 lb. of food; pigs weighing 150-200 lb. required 482 lb. of food, and those weighing 250-300 lb. needed 511 lb. These requirements are all slightly in excess of those obtained in this country recently with skilfully balanced

rations, but they serve to illustrate the point that the heavier the fattening pig, the more food is required to produce 1 lb. of increase.

It is hardly possible to supply first-class porkets (3 score) and bacon pigs from the same litters, but it is possible to supply medium pork pigs of 5 to 6 score and bacon pigs of 7 to 8½ score dead weight from litters of the same pure breed or first cross. The porkets are wanted rather fatter than the baconers, but this can be secured by judicious feeding and management.

**Scale of Business.**—On most farms where pig-keeping is taken up on commercial lines, it will be found convenient and economical to have enough pigs to keep a man fully occupied in looking after them. It is also desirable that the farmer should breed the pigs required for feeding. He is in this way independent of buying in the ordinary market, and avoids the risk of introducing infectious or contagious disease, particularly swine fever.

The number of pigs which a man can look after will vary considerably, depending upon the system of pig-keeping, whether the pigs are confined to sties, or kept under some modification of the open-air system, whether the whole unit is conveniently arranged or the pigs are scattered about the farm, the convenience of the water supply, and so on; but it may be taken as an average figure that a man can attend to about 120 pigs.\* Taking 120 as the unit and assuming that the farmer is breeding and disposing of his pigs partly as pork at about 5 months old and partly as bacon at 6-7 months, with the sows farrowing twice a year, a herd of about 120 pigs would be maintained with 12 to 15 breeding sows and 1 boar. This assumes that the average selling age will be about 6 months, that the litter of a sow will be ready for sale by the time she is due to farrow a second time, and also that each sow rears 14 to 16 pigs in one year.

**Capital Required.**—The total capital required to start pig-keeping on these lines will depend upon how much has to be spent on open-air shelters and fencing. It is usually possible to make use of existing buildings with or without some minor adaptations. Strongly-made wooden shelters big enough for a sow and litter, or for 12 small stores or 8 to 10 bigger stores will cost about £10. Much cheaper shelters of a temporary

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\* Dr. A. G. Ruston, this *Journal*, July, 1920, p. 342.



character can be improvised. Wire pig fencing and posts at present prices will cost about 9d. per yard. It is not wise to attempt to economise by buying second-rate breeding animals. Whether it is intended to keep the herd pure or to go in for crossing, good pedigree animals should be selected as foundation stock. Useful in-pig gilts or young sows of this type will cost from £12 to £20 each, and a suitable boar, fit for service, could be bought at £15 to £25. Over and above the outlay for stock and appliances a reserve of capital of £250 would be needed for the purchase of feeding stuffs and payment of labour and overhead charges until the first returns from sales of pigs are received.

**General Management.**—In order to make the most of the concern the farmer will need to develop keen business instincts. He must learn when it is more economical to use home-grown grain than to sell it and buy other feeding stuffs. Such feeding stuffs as he does buy must be bought with judgment, and he must learn to make up his own rations and not rely on expensive proprietary meals.

With regard to markets it should be his endeavour to sell to the best advantage. It may not be advisable to depend entirely on the local auctions. He should watch the prices at Smithfield and other important centres and compare what he is getting locally with the prices current elsewhere. If there is no weighbridge on the farm he can, by means of a spring balance and crate, weigh representative pigs before they go to market and estimate the price he receives per score. It may be a good policy to send wagon loads direct to London—this would apply particularly in the case of small pork pigs. In the matter of bacon pigs it would doubtless be advantageous both to the farmer and to the bacon-curer to have a definite contract for the supply to the bacon factory of so many pigs at certain stated intervals. Where this is done the farmer should insist upon getting a substantial premium on all pigs which conform to the standard for first-grade bacon pigs.

It is an old saying that pork pigs are not wanted and should not be marketed in the months without an "R"—May, June, July and August. Although there is a good deal of sound sense behind this saying, it is nevertheless true that the demand for pork in the summer months has greatly increased within recent years. Many people endeavour to clear out their pork pigs before May, and then to sell in September those which have accumulated in the summer, with the result

that the markets are often overloaded in March and April and again in September.

**Breeding of Pedigree Pigs.**—So far we have considered pig-keeping from the standpoint of breeding and selling for killing. There is, however, the very important aspect of the position from the point of view of pedigree pig-breeding. Pedigree breeding has done much to promote the production of better pigs. There are possibly certain advantages for commercial purposes in the first cross between two pedigree breeds, but it must not be overlooked that much successful commercial pig-keeping is carried on with pedigree animals. It is often possible with pedigree stock to sell some animals of individual merit at highly remunerative prices, and these prices more than compensate for the extra trouble and time spent in recording pedigrees, in marking, and so on.

To be a successful pedigree pig-breeder, however, a man must be an enthusiast. If he is an enthusiast he should soon become a tolerably good judge, and by paying attention to careful selection and mating he should in course of time build up a good herd. Where the beginner often fails is in registering and keeping for breeding too many of his pigs.

The motto of the pedigree breeder should be to "cull hard," and to send to the butcher or bacon factory all animals except those which have real merit to recommend them. The smaller breeder who starts enthusiastically often gets disappointed through failing to find a good market for his best pigs, and there can be no doubt that collective shows and sales, when properly conducted, form a most valuable outlet for good pigs, particularly for those who are not well enough known, or are not in a sufficiently large way of business to hold successful home sales. These collective shows and sales deserve more encouragement and support.

**Duties of the Pigman.**—In pig-keeping a good pigman is an extraordinarily important asset. The main thing is to get a man who is intelligent, keenly observant, and thoroughly interested in his work. It is very important that he should observe closely in order to see when pigs are ill or off their food, when sows are in season, and the many other small details which collectively make much difference to the balance sheet. He should know the individualities of his sows, and if he treats them properly he will be able to handle them quietly. It is a good indication of how a man treats his pigs if he can



go up to, and handle them in the field, or if they follow him readily when they are called. An intelligent, observant pigman deserves good wages. A bonus of so much per head on each pig weaned, or on each pig which reaches a certain weight in a given time on a weighed ration will do much to encourage him and stimulate his enthusiasm.

**Breeds and Suitability for a Particular Purpose.**—In selecting a breed or cross the farmer must consider what he is going to sell. If his intention is to sell small pork pigs he should choose breeding pigs likely to produce animals which will suit the requirements of the butcher who purveys small pork. If his object is the production of high-class bacon he will find guidance if he ascertains the type of pig wanted by the bacon curer. It is possible that the farmer may find several breeds which appear likely to produce the particular kind of pig which he wants.

*The Pork Pig.*—It has been pointed out that in the case of pork there are three different sizes and weights in demand, but irrespective of weight a good carcass of pork should show a suitable proportion of lean to fat meat. There should be a small proportion of bone and offal. Great length of body is not so essential as in the bacon pig. The head should be broad between the ears, but the jowl, neck and shoulders should not be heavy. The back and loin should be broad and heavily fleshed, the ribs well sprung, the streak and belly thick and well developed, the hind-quarter square, the tail set high, the hams heavy and fleshed down to the hock. The bone should be fine, and the skin thin and not wrinkled, the hair silky and not too abundant. A heavy jowl, strong neck with crest and mane, and heavy shoulders are usually associated with a coarse type of pig. Good quality is essential, and as indications of quality attention should be paid to the bone, skin and hair. A good pork pig will have a high percentage of the most expensive cuts; these are obtained chiefly from the back and loin. For the small and medium pork requirements early maturity is a most important consideration. The pork pig, like the bacon pig, should be free from "seedy-cut." White colour and smooth skin are desirable, as a pig with these characteristics is more easily dressed. A tradesman in a small way of business is much influenced by these points, as he is usually without those special facilities for dressing pigs which are found in the factories and large wholesale businesses.

*The Bacon Pig.*—The ideal type of pig from the bacon curer's standpoint is a long-sided pig with muscular wide back, wide thick firm loins, heavy hams fleshed to the hock, light head, neck and shoulders, thick streak and belly, to weigh dead 140-170 lb. at 6-7 months old. The carcass should show a high percentage of lean to fat, and should be thin skinned. The "Prime Streaky" lying behind the elbow and forearm should be thick and the back fat should not measure more than  $1\frac{1}{2}$  inches in depth at any point.\* The middles from such a carcass will weigh 3 or 4 lb. more than the ends. This description holds good for the Wiltshire side. In the northern counties for the ham and cutting-up-trade a somewhat heavier pig is wanted. The type is, however, the same, and it simply means that for the northern demand the same sort of pig will suit if fed six weeks longer.

When breeding for bacon, pigs that are poor in the hams, short in the back, with coarse wrinkled barrel-shaped sides and narrow behind the shoulders should be avoided. Heavy limbs, heavy fore-quarters, thick skins, coarse hair and bristly manes are equally undesirable.

The ideal bacon pig when fattened should be long, straight on top and underline, not "paunchy," square at the tail-head, light at the shoulder, and fine in the bone.

The ideals laid down for pork and bacon can be secured without difficulty from existing breeds.

**Pure v. Crossbred Pigs.**—Butchers and bacon curers want uniformity. Uniformity cannot be obtained by breeding from mongrels. The only ways in which to secure uniformity of type are to breed pure-bred animals, or definite first crosses between two distinct breeds, and as there is variation in type within some of the breeds, the breeding sows in any one herd should be as uniform as possible. It is invidious to single out particular breeds or crosses, and the following points are given simply for the guidance of prospective breeders of commercial pigs.

*For Pork.*—For "small pork" production the two breeds which are regarded as specially suitable are the Middle White and Berkshire. High-class small pork can be bred from either one of these breeds or by crossing the one with the other. Of the two the Middle White would appear to possess rather earlier maturing qualities, to be rather more prolific, and have an advantage from the butcher's standpoint in the white colour. A white boar used on a coloured sow, however, will usually beget white progeny.

\* The "middle" is that part of the pig which reaches from behind the shoulder to the ham.



For "medium pork" as represented by the pig of 5 score (100 lb.) dead weight, either of the two pure breeds mentioned, or a cross of either of them with one or other of the bigger breeds, would be suitable. The Middle White-Large White cross is popular in some districts, but requires good housing and conditions, and the Middle White-Large Black cross is becoming increasingly esteemed. Both these crosses have the advantage that they can be used also for bacon at 140-160 lb. dead weight. The Berkshire-Tamworth cross is favoured in certain Midland counties and has the reputation of producing a good quality carcass. This cross-bred is, however, rather slow in growing and not specially thrifty.

For "fat pork" the bigger heavier breeds might be more suitable than the Middle White or Berkshire. The Lincolnshire Curly Coated Pig has long been used for producing a fat heavy carcass. The Cumberland yields a useful carcass of this type with good hams.

*For Bacon.*—With regard to bacon production, Denmark produced her high-class bacon pigs by the judicious use of British White boars on the native "Land Race" breed. It has been suggested that in this country the ideal bacon pig can be most easily secured by crossing the Middle White and Large White and then mating this first cross sow with a Large White boar. The question for the farmer to decide is whether the breeding of bacon pigs in this way is the best proposition open to him, or whether by using a breed or cross which may be better adapted to his particular farm and conditions he can, by careful selection of foundation stock, still produce a useful type of bacon pig at possibly less cost. The crosses obtained by the use of a Large White boar on sows of most of the heavier breeds seem to give general satisfaction to bacon curers. Of the newer registered breeds the Welsh in particular appears capable of producing high-class bacon pigs.

As a breeder, as a milker, as a forager, and to live cheaply out of doors, the Large Black sow has many good points, and she is generally recognised as being specially suitable for open-air pig-keeping. Unfortunately, the Large Black, like other coloured breeds, suffers occasionally from the blemish known as "seedy cut." "Seedy-cut" is a black spotty discoloration of the milk ducts in the belly, and occurs in some female pigs, depreciating the value of the side. The progeny of a Black sow and a White boar are generally white and therefore free from "seedy-cut," unless there is visible black colouring along the belly, which is very rare.

The cross produced by the Middle White boar and the Large Black sow would appear to merit more attention from commercial breeders. Both parents are thrifty and cheap to keep. The Large Black sow is more suitable for rough conditions than the Large White. The Middle White-Large Black cross has the great advantage of being a reasonably good dual-purpose animal suiting both the pork butcher and the bacon curer. It possesses early maturity in a high degree, and by those who breed it, is esteemed for its vigour and constitution and the readiness with which it responds to feeding at an early age.

Although it is true that there are many more good pigs in the country now than there were in 1914, the common pig is still more or less a mongrel with little merit to recommend it, and there is great scope for general improvement. Mongrel bred boars are still used for breeding, and this is altogether wrong. Education as well as inexpensive supplies of good boars could do much to secure a sounder breeding policy. The importance of early maturity and the attainment of weight for age cannot be too strongly emphasised, but it appears that possibly too much stress has been laid by breeders upon the ultimate attainment of great size. The big majority of pigs are now wanted for killing at comparatively light weights. What is generally required therefore is a pig which will produce a ripe carcass suitable for its particular purpose at an early age. Such a carcass should be of good quality.

In the cattle breeding world, the breeders of Aberdeen-Angus cattle stand out prominently as having succeeded in developing an early-maturing breed of beef cattle of first-class quality. In the selection of their breeding stock, these breeders chose animals which along with other breed characteristics possessed fineness of bone, and we venture to suggest that in pig-breeding, if early maturity and quality are two essentially important aims, then sires and dams with fine bone must be selected. Certain pig-breeders believe that a sire should have strong bone and an appearance technically described as "sour." This may be necessary if great size is the ultimate object, but it is unusual to find these "sour" sires breeding pigs of the quality and type for which the pork butchers and bacon curers are asking. The day of the big, heavy, fat pig is over and done with, and the sooner this is generally realised the sooner the consumer will be supplied with the article for which he is prepared to pay top price.



## LAND DRAINAGE WORKS FOR THE RELIEF OF UNEMPLOYMENT, 1922-23.

OWING to the continued conditions of winter unemployment among rural workers, aggravated by the depressed condition of agriculture generally, funds were again allocated to the Ministry for land drainage works during the winter of 1922-23.

In the issue of this *Journal* for September, 1922 (pp. 488-494), an account was given of the similar operations conducted during 1921-22—the first period for which money was voted for this form of relief work.

The present article deals with the second grant for this purpose, covering the period from October, 1922, to May, 1923. The Ministry addressed circulars to all Drainage Authorities and County Councils on 6th September, 1922, inviting them to submit schemes and estimates for the improvement of drainage and sea-defence works within their respective areas. County Councils were also invited to submit schemes for water supply to farms or groups of farms.

The terms and conditions set out in each of the circulars were similar to those which obtained in the previous period, the works to be completed before 31st March, 1923. The admitted success of the 1921-22 schemes, both as a relief measure and as a means of effecting solid improvements to several hundred thousand acres of waterlogged land, led to a large increase in the number of schemes submitted. It soon therefore became necessary to ration the allocations of funds in order to spread the schemes over as wide an area as possible to ensure that all rural areas received equal treatment. Eventually, however, sufficient savings were foreseen on schemes already approved to enable grants to be made in aid of all schemes which could be approved on their merits.

Unfortunately the weather conditions were not so favourable as during the previous winter, the rains and floods which occurred early in 1923 causing many schemes to be delayed, curtailed or even abandoned.

Of the 667 schemes for drainage, sea defence and water supply submitted, 531 were approved and carried out, providing employment for 1,018,976 man-days.

The local rate of wages for unskilled agricultural workers as fixed by Conciliation Committees was the normal rate in each case. Skilled men were restricted in the proportion of one to ten unskilled, and in drainage and sea defence schemes the

expenditure on materials was generally limited to about 20 per cent. of the wage estimate.

A beginning was made during October, 1922, and work proceeded smoothly until January, 1923, when flood conditions began to hamper progress, and eventually sanction was obtained for an extension of time from 31st March to 31st May. A further extension of time to 16th June was obtained in a number of special cases to secure the completion of works delayed through various causes.

**Divisional Areas.**—The country was divided into 7 areas for the purposes of inspection and supervision as under :—

*Area No. 1.*—The Ouse Catchment Basin, with the whole of Norfolk and Suffolk.

„ *No. 2.*—The counties of Cheshire, Stafford and Warwick and all counties to the westward, including the whole of Wales.

„ *No. 3.*—All counties northward of a line drawn from the Mersey to the Humber.

„ *No. 4.*—The counties of Lincoln, Leicester, Nottingham and Derby.

„ *No. 5.*—The counties of Essex, Kent, Sussex, Surrey and Middlesex.

„ *No. 6.*—The counties of Wilts, Gloucester and Somerset.

„ *No. 7.*—The counties of Oxford, Berks, Bucks, Herts, Hants, Dorset, Devon and Cornwall.

**Numbers employed.**—The numbers of men employed were as shown in the following table :—

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.
574	2,299	4,537	6,250	7,754	8,625	9,182	8,892	4,471

The total man-months worked amounted to 52,584. The largest number of men employed during any single week was 9,879 for the week ending 28th April.

Of the above numbers it has been ascertained from inspectors' reports that 71 per cent. were ex-Service men, and that 77 per cent. were agricultural or other rural workers.

With regard to the percentage of ex-Service men it should be explained that many rural workers were absorbed on war work in a civilian capacity. In schemes near towns the percentage of ex-Service men reached 87, and in rural schemes was on an average 60 per cent.

The men have worked cheerfully and well, particularly on schemes where the work was well organised and well set out. The average man realised that here he was doing something really useful and not merely digging a hole for his mate to fill in.

Cases in which numbers of men have tramped or cycled many miles daily to and from work could be quoted all over the



Area No.	Numbers of Schemes.			Submitted by		Totals.	Number of man-days worked.	Approximate Expenditure.			Approximate acreage benefited or protected from inundation.
	Drainage.	Sea Defence.	Water Supply.	Drainage Boards.	County Councils.			Drainage. £	Sea Defence. £	Grants in aid of Water Supply. £	
1	58	6	3	42 4	16 2	67	230,700	66,924	2,648	280	225,192
2	82	1	5	21 1	61 5	88	97,057	32,583	2,310	544	63,791
3	26	4	1	7 3	19 1 1	31	73,688	21,229	6,105	27	46,760
4	51	7	2	37 7	14 2	60	197,569	35,642	34,751	11	315,544
5	27	26		20 12	7 14	53	230,018	34,157	46,273		122,363
6	103	3	73	22 3	81 73	179	146,560	28,792	1,619	7,307	121,937
7	38	—	15	3 —	35 15	53	43,384	9,028	—	2,189	17,151
Totals	385	47	99	182	349	531	1,018,976	228,355	93,706	10,358	912,738

£332,419

531

Note:—Expenditure shown for Drainage and Sea Defence is approximate only, and is somewhat higher than final figures.

country. The nature of the work was heavy, and in many cases was of a distinctly unpleasant nature, where many years' accumulation of mud and filth had to be removed from water courses, and where in the course of operations for sea defence in remote localities, blinding squalls of hail or rain and knee-deep wading in the marsh mud, were the daily lot over a long period.

In several cases, Boards of Guardians have co-operated with Drainage Authorities and County Councils in organising schemes with conspicuous success, enabling the local relief of unemployment at a low cost to the rates, and securing the carrying out of much larger schemes of work than the Drainage Authorities could normally afford.

**Analysis of Cases.**—The table on p. 521 gives an analysis of the cases dealt with in the various districts, and shows in some measure the proportionate distribution of the funds in relation to the extent of rural unemployment. The total acreage of land benefited is worthy of note.

**Voluntary Schemes organised by County Agricultural Committees** numbered 349, of which 250 were schemes of Land Drainage and Sea Defence executed at a total cost of £76,182, and 99 were Water Supply Schemes above mentioned for which grants were made totalling £10,358.

The most active county was Wiltshire, where no fewer than 51 Land Drainage Schemes and 45 Water Supply Schemes were carried out, providing employment for 68,590 man-days and benefiting an area of 54,800 acres.

Gloucester was another county responsible for a large number of schemes, which included 24 schemes of Land Drainage and 24 of Water Supply, providing employment for 22,326 man-days and benefiting 19,028 acres.

Other counties in which a fair number of schemes were organised are :—Warwick, Anglesey, Pembroke, Kent, Oxford, Hants. Essex, Dorset, Durham, W. Riding of Yorks, Northampton and Suffolk.

Where so many excellent schemes are included, it is difficult to particularise, but the photographs accompanying this article, which may be classed as typical of the schemes in general, illustrate to some extent the conditions met with, and the nature of the improvement works. In Cornwall, where opportunities for drainage improvements are the exception, much useful work on a small scale has been accomplished.

Many cases could be quoted where large areas of waterlogged land, some of which had deteriorated into impassable bog, have





FIG. 1.—The river Lark near Hengrave Bridge, before cleansing.



FIG. 2.—The river Lark after being cleansed.



FIG. 3.—Stream at Easthampstead, Berks. before cleansing.



FIG. 4.—The stream after being cleansed.





FIG. 5.—The river Elbe, Wilts, before cleansing.



FIG. 6.—The river Elbe after being cleansed



FIG. 7.—Main Drain near Crowland, Lines.



FIG. 8.—Dengie Levels, Essex. Raising and Breasting a Sea Wall.



been reclaimed by the voluntary co-operation of owners in these schemes, through the agency of County Agricultural Committees.

As in the previous period there was a tendency on the part of owners of land at first to assume that under the conditions of working with unskilled labour, and in spite of the Ministry's grant, the work would prove expensive. However, as the schemes proceeded and it was found that such was not the case, there was a general desire for more schemes and for extensions of schemes in progress. In some cases it has been definitely ascertained that work under these schemes has been executed as effectively, and as cheaply, as it would be done at pre-war piece work rates. This reflects great credit on the officials in immediate supervision of the schemes, and also shows the desire on the part of these unskilled workers to make good.

In Kent and Sussex the schemes were mostly those for sea defence, and upwards of 12 miles of sea wall have been raised and strengthened during the winter of 1922-23, in continuance of 1921-22 work. the need for which was emphasised by the high tide of November, 1921.

It may be mentioned that the reason for the apparent reluctance on the part of some County Authorities to prepare schemes has been the lack of the necessary staff. The preparation of each scheme for submission is a lengthy task. Not only had the watercourse to be surveyed and the work estimated, but undertakings had to be obtained from the persons affected for the recovery of one-third of the cost. Where the services of a Drainage Officer had been retained, the schemes have been more in number, and wider in scope than elsewhere.

**Drainage and Sea Defence Authorities** were responsible for 182 schemes at a total cost of £245,879, of which amount £161,892 was spent on schemes of Land Drainage and £83,987 on sea defence.

Of the *Drainage Schemes*, the most striking achievements are those of some of the recently-constituted Drainage Boards:—

By the Ouse Drainage Board, the straightening, widening and deepening of the rivers Ouse, Lark, Ivel, Cam, Thet, Granta, etc., over a total length of  $55\frac{1}{2}$  miles, providing employment for 54,214 man-days; by the Chelmer and Blackwater Drainage Board, the general improvement and pioneer work on the whole of its main channels, in continuance of work commenced in 1921-22, over a length this season alone of 107 miles, providing employment for 34,113 man-days; by the River

Stour (Essex and Suffolk) Drainage Board, the clearance of the tributary streams over a total length of 35 miles, and affording employment for 23,728 man-days; by the Welland Drainage Board, works of improvements affording employment for 2,567 man-days, which works have met with much approval; by the Quadring Fen Drainage Board, and by the Loddon and Blackwater Drainage Association in improvement works of a substantial nature, conferring great benefit to a large area of exceedingly waterlogged land.

As might be expected, the majority of the larger schemes were promoted in the Eastern Counties where drainage works are a vital necessity. A large proportion of the works in the Fens was for the protection of low-lying land from river or lode flooding by the raising and strengthening of old flood embankments over a length of  $60\frac{7}{8}$  miles.

*Sea Defence Schemes* were undertaken on a large scale by the Alford and Spilsby Court of Sewers in the reconstruction of a further length of the sea defence between Skegness and Mablethorpe. When this length is finally completed, it is expected that the low-lying lands adjoining the coast and embracing 40,000 acres in this area will be rendered safe. This work afforded employment for 68,577 man-days, and could never have been done by the authorities out of their own resources. Moreover, it absorbed the whole of the unemployed over a wide rural area.

The Maldon, Wivenhoe and Clacton Drainage Board undertook its initial works in the improvement of its sea walls over a length of 90 miles. Over 25 miles of sea walls were raised and reconditioned, including repair of stone pitching, provision of groynes, and repairs to 35 sea sluices. Under the agency of this Board, the sea defences of West Clacton were reconstructed, and the area between St. Osyth and Clacton rendered safe from sea encroachment. A total of 48,895 man-days were worked on this Board's schemes.

The Arundel Sewers Commission continued the work of raising and strengthening its tidal embankments along the river Arun over a length of  $7\frac{1}{4}$  miles, including repairs to sluices and the construction of groynes: providing employment for 30,548 man-days.

The Pevensy, etc., Levels Commission of Sewers continued effective groyne work on the Pett Level Frontage and have now removed all immediate danger of tidal inundation after being on the brink of disaster for several years. This work provided employment for 6,589 man-days.



Other effective sea defence work was undertaken by the Commissioners of Sewers for Dengie Levels on the repairs to sea walls over a length of three miles, and providing 9,078 man-days' employment.

**Results.**—(a) 385 schemes for the improvement of drainage channels, lodes and subsidiary drains resulted in 2,105 $\frac{3}{8}$  miles of watercourses being cleared of growing and dead timber, and other obstructions; and in the improvement of sections and gradients by the removal of cesses, shoals, bends, and weed accumulations of many years. This work has effected improvement to 746,681 acres of land.

(b) 47 schemes for sea defence embraced the raising and strengthening of earthen walls, repair of stone and concrete pitching, provision of timber and fagot groynes, repairs to sluices, etc., etc., over a total length of 88 $\frac{1}{8}$  miles, and affording protection from tidal inundation to 166,057 acres.

(c) 99 schemes of water supply were carried out chiefly in the higher portions of those counties still suffering from the drought of recent years. They included the building of concrete reservoirs and the tapping and piping of springs.

In a few cases hydraulic ram installations were carried out, and in practically all these water-supply schemes the estimated cost of materials was higher than that of labour: the Ministry's grant covered the cost of unskilled labour only.

It has been ascertained that the actual expenditure in these cases is about four times the amount of the grant, therefore affording considerable additional employment of direct and indirect labour.

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## THE MANUFACTURE OF WALKING STICKS AS A RURAL INDUSTRY.

*(From the Rural Industries Intelligence Bureau.)*

THERE are two main types of walking sticks, the natural and the artificial, or, to be more correct, "manufactured." The former are sticks which are obtained practically to shape as cut from the plantation, and the latter are the turned and artificially bent sticks which have undergone several processes before they can be termed finished articles.

**Natural Sticks.**—Natural stick cutting is a healthy and largely open-air occupation, but is not as a rule a highly remunerative one unless a good connection is obtained. The

stick cutter in a small way of business sometimes purchases the right to cut in a particular wood or plantation, but unless the industry is on a considerable scale, combined perhaps with artificial stick manufacture, it must be considered more suitable for a part-time or seasonal occupation than as the sole means of livelihood. It should be, however, particularly well suited to many partially disabled ex-Service men, especially where they need a country life or are unfitted for employment in urban industry.

There is a considerable demand for this kind of stick, and while the home products are by no means negligible, there is a large volume of imports, both of material and finished articles, and many sticks of both types are made of wood which is not native to this country.

There is a tendency on the part of English stick cutters to regard their processes as secret, and this may operate to restrict the home trade and narrow the numbers employed in it to a select few whose special methods of treatment are, in many cases, a family possession to be handed down from father to son. While there is no doubt that in a craft of this sort long experience provides the worker with many wrinkles, process details, and time and labour-saving devices, these can hardly be regarded as secrets. In this article, however, confined to a description of methods of working in broad outline only, they can only be incidentally alluded to.

Although we have referred definitely to walking sticks, the cutter would not confine his attention to those; there is quite a good demand for his product from umbrella and sunshade manufacturers, both for the stick and handle separately as well as combined, and there are many firms of manufacturers in London and the provinces who are always on the look out for new materials and shapes. So great is this demand that, on the Continent especially, many growers cultivate sticks of various good kinds, solely to supply this market. Little, however, is done in this way in England. Land is generally of too high a value for such cultivation, though one instance has come to our notice where in one of the home counties large quantities of ash saplings have been grown for sticks, with the roots all directed one way, to form cross heads.

The English natural stick-cutter has a large variety of materials to select from, some being more suited for umbrellas and sunshades than for sticks proper. Among them may be mentioned the following:—Ash, aspen, birch, blackthorn.



cherry,\* chestnut,† crab apple, elm, furze or gorse, hazel, holly, hornbeam, maple, mountain ash, whitethorn or hawthorn, etc. When the roots have sufficient size or characteristic shape to form handles or knots the saplings are used, but sometimes also the small branches of larger trees. When cutting for sticks the total length should not be less than 42 in., and preferably 48 in., and they should be between  $\frac{1}{2}$  in. and 1 in. diameter at about the middle of their length, and the diameter should diminish fairly evenly from the root to the tip. If branches are cut, a piece of the parent stem should be left to assist in forming the crook.

*Dyeing, Straightening and Peeling.*—Before it is ready for sale the natural stick undergoes a good deal of manipulation, and various other processes, such as peeling, trimming, bending, polishing, staining, etc., according to the requirement of the finished article. The knowledge and experience of the cutter is particularly needed in estimating, from the appearance of the growing plant, whether it is a good one for his purpose and can be made up with a minimum of difficulty.

Sticks should not be cut earlier than October nor later than the beginning of March. The best period for cutting or pulling is from December to the middle of February. After cutting they should be stacked in a cool and fairly dry place until half dry. The period allowed for this will depend a great deal upon the material and upon local conditions, and must be left to the experience of the worker; it may be anything from 3 weeks to 3 months. Artificial drying is often resorted to, but natural drying produces the better and more durable stick. When the sticks are half dry and the bark is shrunken and will not peel easily, they may be trimmed, straightened and bent as desired. Some sticks, such as oak, are best when barked entirely, others—elm, for instance—frequently have the bark left on entire except at the handle and ferrule end; in other cases they are peeled in patches, some bark being left on for ornamental purposes. As a rule the better-class stick is peeled entirely, trimmed and smoothed, and after seasoning, polished or varnished.

There are many methods of straightening, in fact, individual workers are seldom found to use exactly similar processes, and it is remarkable to those ignorant of the craft, what can be done by skill and experience in straightening and bending the most

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\* The English cherry is not so much used as what is known as the "tiger cherry," imported from Hungary.

† Spanish chestnut (*Castanea sativa*).

irregularly grown and crooked sticks. The following are among the more common methods of producing suppleness preparatory to bending :—

- (1) The sticks may be exposed to steam vapour.
- (2) A bath of damp sand is kept at a temperature about equal to that of boiling water by being placed over a very hot stove, and the sticks are plunged into this until hot and quite supple. This, or a variation of it, is the common method.
- (3) Another method of drying and straightening single sticks quickly is to insert them after rough straightening into a metal tube, such as a piece of iron gas pipe, of a suitable size, boil it in the tube for about an hour, then dry it in its tube quickly, either by putting stick and tube in the chimney above the fire for 24 hours or so, or by other suitable artificial means. This method is sometimes practised on green and unseasoned sticks, but these are not as a rule durable.

There is no hard and fast rule as to peeling either before or after straightening; both methods are practised, and often by the same individual, according to the wood he is using and the class of stick he intends to make. The bark may be removed with a sharp knife, care being taken not to damage the wood underneath; or the sticks may be immersed in hot water rather below boiling point for an hour or so; or better still, they may be put into cold water, and slowly heated, water and sticks together, for about 3 hours, after which they can be easily peeled by hand.

The equipment of the small stick maker is often of the simplest and crudest description, and his straightening and bending apparatus is no exception. He usually has a stout bench running down one side of his workshop or outhouse, with the front reinforced with a heavy hardwood plank, such as 5 in. by 3½ in. elm. Into this are driven a number of stout pegs or iron staples in suitable positions and of varying heights by which he can get any purchase he wants, either for straightening or crook bending. Another straightening appliance is merely a notch cut in a stout piece of wood set on end, and at an angle to the worker, in which the stick is inserted at various points where alteration is required, while the eye can glance along it during the operation. When finished it is put on one side to cool, which it should do with little or no tendency to revert to its original shape. A more elaborate method used for better-class sticks, or those made of more stubborn wood, such as holly, oak, hawthorn, etc.), is that of the straightening boards; these are wide and thick pieces of wood, generally beech, with a number of straight grooves of various widths cut in them. The sticks to be straightened are placed in the grooves while hot and pliant, and secured against



one side by wedges driven in at intervals and left to dry as fixed. Semi-circular crutches can be bent by immersing the end in boiling water for from 10 to 15 minutes, then bending it to the desired form either by hand or by means of a couple of staples in the bench; the crook is then secured in this position either with a tourniquet or by being placed on the bench with small pieces of wood nailed down round it.

Apart from the common curved handle, sticks can be bent or twisted by the application of heat when in this pliant state to almost any shape in reason, such as the twists, curls and spirals seen in some fancy sticks; while umbrella and sunshade handles, especially those made of cane or bamboo, are sometimes even tied into knots. After bending, straightening and trimming, the sticks are put into a dry airy place, not too hot, to get thoroughly dry and seasoned. Single sticks may be hung up with a weight on the end to keep them from warping, but the usual practice is to tie a bundle of them tightly together, and they then keep one another straight. The tendency to distortion should not be very great if the straightening has been well done. Some workers hasten this process by carrying a brick flue from their fire up through the loft or other drying place. The sticks must anyway be so arranged that air can get thorough access to them.

*Finishing.*—The finishing processes vary widely according to the quality of the stick, the purpose for which it is required, and the material of which it is made. They range from no finishing at all beyond perhaps putting on a ferrule, to the most elaborate trimming, smoothing, staining, polishing and carving, according to customers' requirements. One or two of these finishes may be indicated as follows:—

(1) Some sticks (*e.g.* hazel) are merely buffed up with a wax mop to give the bark a natural sort of gloss, and the hook end trimmed up and carefully rounded off and touched up if required with a hard slow-drying varnish.

(2) Elm sticks with the rough bark left on must be trimmed clean round the neck and on the handle or knob, and at the ferrule end for an inch or two, any loose bark on the stem being also cut away. It is then smoothed a little with sand paper, coated with boiled linseed oil and allowed to dry. When dry, the smooth parts should be polished up and the whole varnished with hard varnish—one or two coats as required.

(3) In some cases hazel, ash, holly, birch or apple sticks have only a part of the bark removed and the knots or other protuberances smoothly trimmed down. They are then rubbed over with glass paper, dressed with boiled linseed oil, and dried, polished and varnished as in (2). Hawthorn sticks may be treated in the same way, while oak sticks are best entirely stripped of bark and then treated similarly. The trimming may be done with a spokeshave, a small plane, or a knife.

(4) The forming of handles and knobs must be left to the discretion of the worker; much depends on the natural shape of each stick and the use to which it is to be put. For fancy sticks, the knobs and handles may be elaborately carved, but if for ordinary use, they are better smoothed and rounded to fit comfortably into the hollow of the hand. To the experienced worker the shape of the root in the rough will itself usually suggest the most suitable treatment.

(5) Sticks and umbrella handles are often stained, particularly when they are trimmed smooth all over. This may be done either by putting on the stain hot with a brush, or by immersing the stick in a heated solution; the former is the mode most commonly adopted by the small maker. Staining should be done before the sticks are dressed with linseed oil. Stains in a great variety of tints can be so easily and cheaply purchased with full directions for their use, that it is hardly worth while to describe methods of making them up, but a very good black stain is obtained as follows:—

After smoothing, but before oiling, brush the sticks over with a hot and strong solution of logwood and nutgalls, and when this is quite dry, brush them over again with vinegar or acetic acid, in which a quantity of proto-sulphate of iron, iron rust, rusty nails or rusty iron filings have been lying for some days. Other methods of colouring may be obtained by adding tinting materials to the polish used, such as dragons' blood, to produce a mahogany colour, or yellow ochre to produce a yellow coloured stick. Further details on these processes can be supplied if desired.

(6) Ferrules can be bought much more cheaply from wholesalers than they can be made, and can be obtained in a variety of sizes and qualities. They should be fixed with two small screws or nails, one on either side, to prevent them falling off, when the stick shrinks in dry weather.

**Artificial or Manufactured Sticks.**—This section of the industry, although carried on abroad to a considerable extent as a rural one, is perhaps unlikely to interest the small and local worker in this country to any great degree, but the following description is typical of several village factories in Austria and Hungary. Considerable use is made nowadays of machinery and power, and mass production is essential under modern and factory conditions. Large use is made of foreign, and often rare and valuable woods, which are specially imported for the purpose; and instead of the naturally shaped saplings, seasoned timber is mostly used, which is cut up as required, turned or otherwise machined to shape, and bent by machinery. In the manufacture of the higher quality of sticks and parasol handles, workers in gold, silver, precious stones, ivory, etc., are often required as well. There is no doubt, however, that some of the methods in vogue are more or less applicable to the rural worker, who might well devote his attention to making a certain proportion of the so-called artificial sticks



with the aid of wood-working machinery of a more or less elaborate kind, according to his circumstances or the volume of his business, and for this reason it is thought that the following brief general outline may usefully be given here.

When green timber is to be employed it is cut into scantling or heavy planks, and then subjected to much the same methods of seasoning as that referred to in the case of natural stick-making, except that it is more common to find artificial means of hastening the process resorted to. The timber now seasoned and dry is cut up into rods of square section, and this cutting is done so as to make the greatest possible use of the run of the grain. Skill and experience are necessary to make a proper selection here, particularly when rare and valuable woods are in question. These rods are from 42 in. to 48 in. in length, and after cutting they are rounded in a special lathe which turns them to the exact shape or taper required.

Various types of lathes are used, such as copying lathes which will turn two or three sticks at a time, working from a rotating metal former. Sometimes what is known as a golf-stick lathe is used: this is rather an expensive and specialised machine, but is in some respects merely a special sort of combination copying and profile lathe. The profile lathe is quite suitable so long as attachments are provided to support the long and slender piece of wood whilst it is being turned. A profile lathe is a copying lathe in which the rotating former is replaced by a fixed metal or hardwood template.

The small worker could quite well use the simple wood turner's lathe with some form of support to prevent the stick being broken or forced out of centres whilst turning. With such a machine, however, the output would not be so great. It is a common, but not invariable, practice to leave the crook end of the stick square or rectangular in section until after bending. Machine bending is done more safely and satisfactorily with the wood in this shape, and the handle can be finished to shape more perfectly afterwards. This shaping is sometimes done by hand-tools, but the rapid method is to use a rotating fly-cutter in the ordinary wood machinists' vertical spindle machine. The cutter is shaped to the quarter of a circle, and by means of jigs the inside and outside of the crook can be shaped in a few seconds. The stick is then turned over and the other side treated the same; the neck piece still remaining of square section between the handle and the stem is then trimmed down with a spokeshave. In the factory

these operations are generally done by girls, and the smoothing of the rods, instead of being done by hand, is more rapidly effected on a belt-type sand-papering machine. The softening of the sticks for bending is done by steaming them in a special apparatus supplied with low pressure steam (about 10-20 lb. per sq. in.) from a boiler. This boiler also supplies steam to the staining plant. The steaming drum is used for taking full length sticks, and a steaming box of a different and more compact type may be employed when handles only are being made. Both are arranged to be kept continuously in action, having a number of compartments which can be filled and emptied successively without disturbing the others. The steaming process occupies from 1 to 2 hours, varying with different timbers, and from 10 to 20 dozen sticks or handles can be steamed at a time. The hot and flexible sticks, when ready, are taken to the power-driven bending machine in which they are held by an adjustable cramp with a spring steel strap and bent round a heated circular former of chilled cast iron, which is removed with the stick when bending is completed, and a fresh one inserted ready heated for the next stick to be operated on. The bent stick remains attached to the former by the bending cramp until cold, and the heat remaining in it dries the stick out completely at the same time, without charring the wood at all. The bends take about  $1\frac{1}{2}$  to 2 hours to dry and set. The above methods ensure a large and rapid output of uniformly bent handles. This method is chiefly used where handles are separate from the stem, enabling an ivory, galilith or erinoid washer to be inserted between the two for ornamental purposes.

The end is prepared for ferruling by a special rotating cutter rather similar to a spoke trimmer which tapers the end of the stick an exact fit in the ferrule, which is then driven on and stamped in a fly-press to produce two small depressions of the ferrule into the wood to hold it in place; it is seldom that the factory-made stick has the ferrule screwed or nailed.

This description of the manufactured walking-stick industry is intentionally no more than a brief outline. The Bureau, however, would be glad to give information in greater detail to individual inquirers if desired. Application should be made to *The Secretary, Rural Industries Intelligence Bureau, 258/262, Westminster Bridge Road, London, S.E.1.*

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## GROWING RED CLOVER SEED IN WALES.

V. S. ELLIS, P.A.S.I., and R. D. WILLIAMS, B.Sc.

FOR many generations two districts in Wales have been famous for their red clover (1) the Vale of Clwyd and extending from Abergele and Rhyl on the coast up to several miles above Ruthin, and (2) that portion of Montgomeryshire extending to a radius of from 10 to 15 miles round Welshpool, and a little over the border of Montgomeryshire into Shropshire in the vicinity of Chirbury.

Experiments conducted at the Welsh Plant Breeding Station, Aberystwyth, with different nationalities and strains of Red Clover and extending over a period of four years, have demonstrated most conclusively that Montgomeryshire Late-flowering Red Clover is very considerably more persistent than any foreign Red Clover. The relative yields during the second harvest year of Montgomeryshire Red, Cornish Marl Red—a strain grown in Cornwall which is very similar to that grown in Montgomeryshire—and some of the most common foreign nationalities are given below:—

Montgomeryshire Late-Flowering Red	...	...	100
Cornish Marl Red	...	...	100
Canadian	...	...	46
Chilian	...	...	24
Italian	...	...	0

As the experiments on the Vale of Clwyd Red Clover were only commenced in 1922 comparative figures are not yet available.

Similar experiments have also been carried out in the past at the North of Scotland College of Agriculture, and here again Welsh Red Clover has shown excellent results as compared with the other varieties.

The strains grown in the two seed-growing centres in Wales are quite distinct, although both are highly persistent types of the late-flowering red. A broad red type of clover is also grown to a limited extent in the Vale of Clwyd. It has been claimed that this strain is more persistent than the English Broad Red and that it lasts well into the second harvest year. The two late-flowering strains characteristic of Wales may be briefly described as follows:—

*Montgomeryshire Red* is a very “late-flowering” strain. It is easily distinguished from other strains of “single cuts”

by its very dense tufted habit of growth and by its relatively small leaves. The plants are generally sub-prostrate during the early stages of growth. It tillers more freely than any other strain except the Cornish Marl. It does not afford much keep during the winter and early spring, but, though late in commencing active growth, it will usually give a very heavy late hay crop. Its aftermath, as compared with that of English Broad Red or even English Late-flowering Red, is poor. Its outstanding quality is its persistency, and it is therefore pre-eminently suitable for seeds' mixtures intended to be down for three years or more. It is undoubtedly one of the best clover strains for pastures.

*Vale of Clwyd Late-flowering Clover* is, on the other hand, a medium early "late-flowering" strain. It is usually sub-prostrate to semi-erect in habit of growth. The leaves are appreciably larger than those of Montgomeryshire Red. It tillers freely but not so much so as the Montgomeryshire strain. It yields, however, better grazing during the winter and spring, and gives an earlier hay crop and more aftermath. A high degree of persistency is claimed for this strain, but it is not such a good plant for grazing purposes as the other Welsh strain.

As the superiority of Welsh Red Clover over other strains for lasting into the third and fourth years and for its hardiness has been clearly demonstrated, steps have been taken with the object of fostering the growing of this seed and of improving the facilities for cleaning and marketing.

With this end in view two conferences were convened last year at Welshpool and Denbigh, in the respective areas in which this seed is grown, and were attended by all the principal growers in the districts. As a result of these conferences a subsequent meeting of growers took place at Denbigh last September when an Association was formed and called the "Vale of Clwyd Red Clover Growers' Association," and last January a similar Association was formed at Welshpool to be known as the Montgomeryshire Welsh Red Clover Seed Growers' Association. Similar rules and regulations, providing for the certification of the true strains and the testing of the seed under the Seeds Act, 1920, were drawn up by each Association.

Although the quantity of seed available each year will vary in amount owing to the uncertain climatic conditions existing in Wales there is no reason why the acreage at present under



these clovers should not be considerably increased as the excellent qualities of the seed become more extensively known.

A good deal still requires to be done in the way of improving facilities for cleaning, and, what is even more important, the earlier threshing of the seed so that it can be cleaned, tested and placed on the market at the commencement of the following seed season.

If the growers will only now seize their opportunity and give their whole-hearted support to the two new Associations formed there appears to be no reason why in a few years' time the true strains of Welsh Red Clover should not have a world-wide reputation.

It also is interesting to note that at a meeting of the Committee of "The Vale of Clwyd Association, held at Denbigh on 27th June, it was decided:—

- (1) To appoint a qualified botanist for the purpose of inspecting the clover fields so that the true strain could be certified; and
- (2) To concentrate on the development of the permanent late-flowering Red.

The Secretary of the Vale of Clwyd Society is Mr. Arthur E. Roberts, 131, High Street, Rhyl, and of the Montgomeryshire Society, Mr. Havercroft Jones, Wesley Street, Newtown, N. Wales, to whom all inquiries regarding the purchase of this seed should be sent.

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## GARLIC-SCENTED PENNYCRESS: A WEED NEW TO BRITAIN.

W. M. WARE, B.Sc., and J. E. CHAMBERS,  
*South-Eastern Agricultural College, Wye.*

GARLIC-SCENTED Pennycress (*Thlaspi alliaceum*) is an annual plant closely related to the Pennycress (*Thlaspi arvense*) already familiar to farmers as a weed of arable land. Examination of a weed-infested arable field in the neighbourhood of Hothfield, near Ashford, Kent, in May, 1923, led to the discovery that Garlic-scented Pennycress was present in abundance. This plant, a native of south Europe, does not appear to have been previously recorded as a weed in Great Britain. The area infested was 15 acres farmed under the Norfolk four-course rotation. The crop taken in 1922 was wheat in which the weed occurred sparingly, but owing to continued wet weather in autumn and

spring, the soil, a heavy clay, was unworkable and weeds consequently covered the stubble. The plants on the field were so numerous in May, as to resemble a crop being grown for seed. The average height was approximately two feet.

**Description.**—Individual plants show erect habit of growth; the majority have four to ten branches arising from close to soil level and occupying considerable space (Fig. 1). The whole plant is free from hairs, and when bruised emits a strong garlic—or onion-like smell. The lower leaves clasp the stem and the upper are provided with short stalks, though on the mature plant the majority have usually withered or fallen. The flowers are white, small and inconspicuous. The fruits or pods are borne on slender stalks in great numbers on all the stems, and their edges are flattened to form a narrow rim or “wing” which is notched at the top. They differ from those of Pennycress in that the latter are longer, broader, and are provided with a larger “wing.” The difference in shape of the pods and of their central membranous partitions is shown in Fig. 3.

To each side of the membranous partition within the fruit, three or four reddish brown seeds are attached; these can easily be observed if the two “valves” of the fruit be removed. Fruits of common Pennycress contain seeds of much the same colour and size\* as those of Garlic-scented Pennycress, but in greater numbers and having the seed coat marked with very conspicuous ridges which are approximately parallel to the outline of the seed. The seed coat in the case of *Thlaspi alliaceum* is ridged, but less conspicuously, and the ridges themselves are pitted throughout their entire length (Fig. 2). The fruits and seeds ripen at the middle or end of May.

**Origin.**—As already indicated, this weed is a native of south Europe, where it appears to be of general distribution. Specimens in the European Herbarium of the British Museum are labelled as follows:—Stiria, Salzburg, Loire Inférieure, Piedmont, Italy, Sicily, Croatia, and descriptions in Continental Florast indicate that in addition to the above, it is found in Spain and Rumania.

It is of interest to note that in the British Herbarium, at the British Museum, there is one specimen with incomplete description, presumably collected in Britain. This was origin-

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\* The average size of the seed is 1·8 mm. × 1·3 mm.

† *France*: Rouy et Foucard II, 146, Flore de France, 1895.

*Italy*: Parlatore, Filippo, IX, 694, Flora Italiana, 1890-93.

*Spain*: Willkomm et Lange III, 776, Prodomus Florae Hispanicae, 1880.



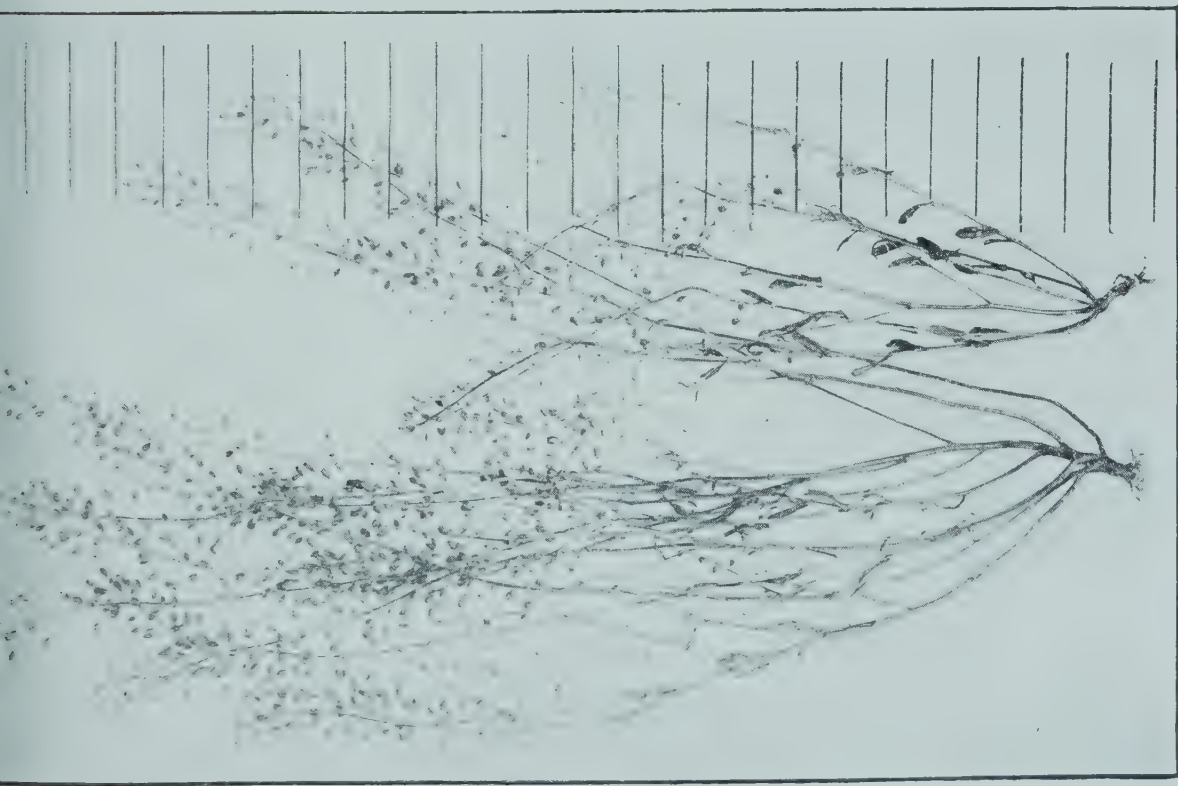


FIG. 1.—*Thlaspi alliaceum*, Garlic-scented Pennygrass. (The height of the weed in inches is shown by the lines on the right.)



FIG. 2.—Left, seeds of *Thlaspi alliaceum*.  
Right, seeds of *Thlaspi arvense* (Pennycress.)  
All  $\times 10$ .



FIG. 3.—*Left and right*, mature fruit pods of *Thlaspi alliaceum*.  
*Centre*, mature fruit pods *Thlaspi arvense*.  
Natural size.



ally in the Lightfoot Herbarium and is therefore approximately 150 years old. *Thlaspi alliaceum* is mentioned by J. C. Loudon in his Hortus Britannicus, 1832, and in connection with this plant, under the heading of "Year of introduction of Exotics," appears the date 1714, though no other particulars of its occurrence in Britain are detailed in this or later editions of his work.

**Occurrence on Arable Land.**—Reference to the labels of the Herbarium specimens mentioned above, shows that this plant is a weed of arable land on the Continent, being found in crops of cereals and of lucerne. It has been reported in one instance in Italy as constituting a large proportion of the fodder fed to certain oxen which had suffered in consequence, and from information in the Floras mentioned above, it would appear to be widely distributed, being found in vineyards, fields, hedges, woods and grassy places. It is described by Woods\* as occurring in arable fields of mid and south Europe.

It has probably been introduced to England as an impurity in some such seed as that of lucerne or red clover, but the farmer at Hothfield could give no exact information on this point; he stated, however, that he had observed the weed for many years.

**Harmful Properties.**—When once allowed to ripen and shed seed, it is evident that this weed can do considerable harm, either by necessitating increased cultivations to eradicate the seedling plants or by its smothering effect on crop plants if allowed to grow to maturity. In the latter event the seeds are ripened early, and in most cases will be shed before the weed can be removed with the crop, thereby increasing the infestation in the following year. The soil of the field under observation was so thickly coated with the seeds that in places it assumed a reddish brown colour. Samples of the soil, removed to the laboratory, were dried and crushed, with the object of carrying out an estimation of the seeds they contained. The soil had a strong odour of garlic

Some idea of the number of seeds deposited in the soil was obtained by counting the plants on measured areas,† the average number of pods per plant,‡ and seeds per pod.§ This amounted to 79,768 seeds per square yard.

More direct harmful properties may be attributed to this

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\* Joseph Woods, Tourist's Flora, 1850.

† Average 13 plants per square yard.

‡ Average 767 pods per plant.

§ Average 8 seeds per pod.

plant. In May, 1917, a case of poisoning of oxen is recorded by Beguinot,\* in Italy. Of 40 poisoned animals, 8 had died and their fresh-cut fodder, when examined, was found to consist largely of *Thlaspi alliaceum*. No other cause of poisoning or death was found, and the author advises that neither this species nor ordinary Pennycress (*Thlaspi arvense*), should be allowed as an impurity in fodder. It is further stated to cause tainting of milk if eaten by cows. In connection with this, it is of interest to note that Pennycress (*Thlaspi arvense*) is known in Canada as "Stinkweed," though not possessed of such a strong odour as that characteristic of *Thlaspi alliaceum*.

**Eradication.**—Garlic-scented Pennycress being an annual, and propagated entirely by seeds, must be dealt with before the fruits have ripened. Harrowing and subsequent hoeing should be practised, as in the case of charlock, until the plant is in flower. After this stage it is advisable to hand-pull and burn, care being taken that no plants with immature pods are left to be ploughed in, as it is quite possible that such fruits may ripen seed below the soil. Unless such measures are adopted, the land will become infested with the seeds as above described. In the case under consideration the farmer has repeatedly noticed that when a cereal crop was being taken a heavy seeding invariably resulted in partial suppression of the weed.

Under normal conditions, *i.e.*, when cultivations are not adversely affected by the weather, there is no excuse for its becoming a pest, and there seems no doubt that this weed can be effectively controlled.

The writers desire to express their thanks to the Director, Royal Botanic Gardens, Kew, for identification of the plant. They are also indebted to the following gentlemen for information kindly supplied: Mr. C. B. Saunders, Chief Officer of the Official Seed Testing Station, Cambridge, Mr. A. J. Wilmott, British Museum (Natural History), London, and Mr. H. C. Long, Ministry of Agriculture.

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\* Augusto Beguinot, in *Atti dell' Accademia Veneto-Trentino-Istriana*, Vol. X, pp. 99-110. Padua, 1917.

Abstract in *International Review of the Science and Practice of Agriculture*. Year IX, No. 6. Rome, June, 1918.



## POULTRY-KEEPING AND FRUIT CULTURE.

J. TURNBULL AND C. A. FLATT,  
*Ministry of Agriculture and Fisheries.*

THE advantages of running poultry under fruit trees are becoming more generally recognised and the practice is spreading rapidly, especially in Cambridgeshire. From the point of view of the poultry keeper, the rent of the land is paid by the fruit, and ample space together with a generous supply of insect life is obtainable free of cost. Further, an immediate use is found for the manure without any trouble of storage or transport. If the advantages from the poultry keepers' point of view are great, those secured by the fruit grower are even greater. A great part of the expenditure on labour and material required for spraying the trees and manuring and cultivating the land is saved.

Many of the principal insect pests of fruit spend much of their time on or in the soil, and it is at these times that they are caught and consumed by poultry. All kinds of caterpillars, maggots, aphides, and even weevils, are readily devoured. Some of the worst pests of fruit, such as weevils, pear midge, maggots, etc., are more effectively dealt with in this way than in any other. In addition, the land can be cleared of such harmful insects as leather jackets, wireworms and ants (which are so active in spreading the dreaded purple aphis).

Organic manure is a source of expense and difficulty to the fruit grower and this can be largely supplied by poultry. Many fruit plantations are so starved that only small crops of poor fruit are obtained, and an immediate improvement would result by the introduction of poultry. A number of instances are to be seen of the effect of the poultry running in the orchards as against orchards on adjoining land not so stocked. The greater vigour of the trees in the former case seems to enable them to withstand frosts and attacks of disease, which have this year done much damage. Successions of good crops are reported from plums, and there is little doubt that for increasing the size of the fruit, poultry manure is unsurpassed.

The cultivation of the land in fruit plantations is another expensive item, and this can be done either wholly or in part by poultry. With bush fruit and young apple, pear and plum trees up to five or six years old, it is essential to keep the land cultivated, but the amount of cultivation required will be con-

siderably lessened by poultry. With older trees, however, no cultivation is necessary. Two hundred hens per acre will keep the land clean. One hundred hens per acre will largely keep down grass, etc., and will secure the high colour of apples without the reduced size generally associated with grass orchards.

Various methods of combining poultry keeping with fruit culture have been adopted by different growers with success, and a brief description of these is now given.

Mr. J. G. Faircliffe, of Burwell, Cambs, has run poultry under fruit trees for twenty years in the orchards (extending to some 50 acres) of Mr. R. Stephenson at Exning. He also has a younger plantation of about 5 acres of his own at Burwell, where he puts into practice his latest ideas. At first large houses placed at one end of large enclosures were made. In his experience, however, the poultry only worked near the houses, and the size of both pens and houses has therefore been reduced and the houses placed in the centres of the pens. At Exning the pens are now five to the acre and each holds 2 dozen laying hens. At Burwell the pens are 15 to the acre and each holds 10 hens. In either case sufficient pens are reserved for chicken rearing. Light breeds were preferred at first as they work more ground, but it was found that they will get up into bush apple trees and strip them of fruit when half grown. The light breeds have therefore been abandoned in favour of White Wyandottes and Rhode Island Reds. Runner ducks have been found to improve rough ground more quickly, but this advantage is considered to be outweighed by their failure to lay when checked by a cold snap in winter or otherwise upset. The trees at Burwell are twelve to fourteen years old. They have had poultry amongst them for seven years and have carried five or six consecutive heavy crops. No spraying has been necessary, and what may be considered proof that the poultry deal effectively with the pests is to be seen in the actual presence of only small numbers of the various caterpillars, blue and green aphids, apple blossom weevil, etc., which in a season such as this would have increased largely but for the activities of the fowls.

Mr. T. H. Langan, Willingham, has run poultry under his fruit trees for several years. He states that a plantation of Victoria plums in the fen district had never produced anything but "skin and bone" until he put in poultry. Last year he secured a first-class sample of large plums and this year it has one of the few crops in the district. At another orchard half acre pens were made and an intensive house with 100 hens was put in



each last September. Mr. Langan is now trying a plot of several acres with a large house in each corner. At the blossoming period, the apple trees around the pens were very forward in leaf and blossom, while those further away were rather weak and backward. The large amount of ground worked by Anconas—much larger than Leghorns or any heavy birds—was very marked. Mr. Langan has 2,000 layers and has recently installed a Mammoth incubator with capacity for 4,000 eggs and a plant capable of rearing 6,000 chickens. He intends to increase his hatching capacity very largely next year.

Messrs. Chivers & Sons carry on their various farms a large head of poultry, consisting of Light Sussex, White Leghorn and White Wyandotte; the first breed is much favoured. The main poultry operations are centred at one farm under the charge of an experienced poultry man with four assistants. The stock are bred and the chickens hatched and reared in the early stages at this farm. The total incubator capacity is about 7,500. The breeding stock is trap nested and very carefully selected, and good laying strains of all varieties have been established. The young stock are drafted out at 8 to 12 weeks of age, and later some of the best pullets are brought back to the poultry farm into large flock houses and trap nested. In the extensions now anticipated, the laying flocks will be in units of 350 with approximately 140 birds to the acre.

The pens vary considerably in size from  $\frac{1}{2}$  acre up to  $2\frac{1}{2}$  acres, but in most cases the land is kept cultivated. In some cases the trees are widely planted and there are two runs to each house—one growing a crop of greenstuff, while the other accommodates the poultry. This system both provides greenstuff for the poultry and prevents the land becoming foul. Where the trees are planted at the usual distances, greenstuff is not grown, but is supplied to the birds from other land, and the fruit land is kept cultivated. Chicks in the early stages are run on grass under the trees.

The stocks of poultry, which are pure bred and of good strain, are particularly vigorous and healthy. The conditions, which afford ample range and every inducement to exercise, lead to vitality and good results in breeding and rearing. Although it is sometimes stated that laying hens do less well under trees during the autumn and winter months than under more open conditions, there is no evidence to prove that this has any effect in checking egg production. The returns reported during these months are very satisfactory, and it is probable that the shelter

which is afforded in the orchards from the north and east winds is a set-off against damp during the rainy season. The benefit of the shelter from sun during the summer months is a very distinct asset to all the stock, particularly to the young birds.

No general system of housing is followed by the different breeders. Scratching sheds of large type and smaller colony houses are used for the laying birds. Although the provision of scratching sheds may appear to some extent to defeat the object of keeping the poultry to benefit the orchards, in that they would roam less, there is no doubt that with large flocks, scratching accommodation is a wise provision. It is unnecessary, however, where the flock unit only amounts to ten or twelve birds.

It is probable that, as claimed in one instance, the small flock is preferable from the point of view of poultry production as well as for the sake of the orchard, where operations are upon a small scale. Upon a larger scale, however, the additional supervision of employed labour, the extra labour required, and the additional cost of equipment, are all in favour of larger flocks.

In the same way in the feeding of wet and dry mash, both of which are practised, the latter system is of great advantage to the fruit grower whose orchards are frequently at some distance apart, even if the results from the poultry should be less good. The preparation and distribution of wet mash under these circumstances adds considerably to the labour. Feeding costs are, however, frequently cheapened by the use of surplus potatoes, and this necessitates a wet mash. It is worthy of note that the ration of animal food in the mash fed to fowls is considerably reduced during the periods of cultivation.

The capacity of a fruit grower for long and irregular hours of work and his essentially practical and observant nature, make him particularly adaptable for the successful management of poultry. The fact that both poultry and fruit trees require constant attention is an added advantage, as when run in conjunction, important details in management do not long escape attention.

A method advocated by one of the pioneers in this area for establishing a new orchard, is to plant small fruit between the young trees. The returns from the small fruit meet all expenses in the first few years, after which poultry are turned in as the trees commence to come into profit. During the ripe fruit season, poultry would be likely to damage small fruit, and they should be removed to other quarters at this time.



There are still many established orchards which would benefit largely if stocked with poultry, but the cost of equipment is a consideration, since a good deal of wire netting is required. It is generally found, however, that 5 ft. netting is sufficient for any purpose, and in some cases 4 ft. netting is used where only heavy breeds are kept. Bad fruit seasons, however, are those in which more attention is called to the value of the poultry in controlling the many pests to which fruit trees are subject.

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## LAVENDER: ITS CULTIVATION FOR MARKETING AND DISTILLING.

A. H. HOARE,

*Ministry of Agriculture and Fisheries.*

LAVENDER has been grown commercially in the south of England for a great many years, having been introduced in 1568, and where the soil and situation are favourable, there is no doubt that it is a profitable crop and worthy of consideration. Lavender is grown for sale in a fresh state as "bunched lavender," for sale as "dried lavender" for sachet making, etc., and for the production of oil of lavender for perfumery purposes. As regards oil production it is pointed out that chemistry has not yet succeeded in producing a synthetic product which can claim to be a substitute for English Oil of Lavender, and hence the supply depends wholly upon the natural product. The variety grown, and which should be grown, commercially in England is *Lavendula vera*, of which several strains exist, and usually referred to as "English" lavender. The chief lavender growing districts in the past have been in the neighbourhood of Mitcham, Hitchin, Canterbury and Bournemouth, the Mitcham oil of lavender having become world famous as a product unequalled by that of any other country.

**Soil and Situation.**—Too much stress cannot be laid on the importance of soil and situation. These are the factors governing success, and should be carefully considered before steps are taken to plant any large area. In common with all plants containing a high percentage of oily matter, lavender needs very little moisture and does best in a calcareous, stony, well-drained soil in dry sunny situations. The ideal soil is a light brown loam overlying chalk, although sandy loams, provided

good dressings of chalk or lime are applied, may be utilised. Heavy soils which hold water are not suitable.

Situation is quite as important as the soil, if not more so. Lavender is by nature a sub-tropical plant, although fond of high altitudes. It is liable to injury by frost and hence low-lying situations and those prone to become weather-bound in winter should be avoided. Even under favourable conditions in England a hard winter may result in a number of plants being killed by frost. The situation should be exposed and sunny, preferably sloping to the south, and protected, if possible, from the prevailing summer winds by a belt of trees or a high hedge. This matter of protection is important, as considerable damage may be done by high winds when the tall flower spikes are being carried by the plants during July and August.

**Preparation and Cultivation of the Land.**—It is supremely important that the land be properly prepared by deep and thorough cultivation. Potatoes which have been well manured make an excellent forecrop, as the thorough working of the land will prepare the way for the lavender.

After planting it is essential to keep the land in a thorough state of cultivation while the plants occupy it in order to secure a good annual throw of bloom. If possible a horse-hoe should be used for this purpose and the land worked both ways and as close to the plants as possible.

**Plants and Planting.**—The plan most favoured after a supply of plants is secured is to plant them out 18 in.  $\times$  18 in. very carefully on the square. When these plants have occupied the ground for one year, each intervening plant and those of every other row are taken out, leaving the land planted 36 in.  $\times$  36 in. The plants so removed will be utilised for planting up fresh ground, each being divided into about three. Before being planted the plants should be trimmed at the top and the rough roots removed to where the fibrous roots have developed. The usual practice is to use a straight chopper and clean wood block for preparing the plants for replanting.

Planting should be done in October or early spring. November and the winter months should be avoided, as the plants are then liable to injury by frost and snow when out of the ground. It is important to plant very deeply. Special dibbers are used not less than 14 in. long, and the plants should go into the ground up to within 2 in. of the top and be very firmly closed in.



In commercial practice the bushes are seldom retained after their fifth year, after which they should be grubbed and burnt. It follows, therefore, that in order to keep up a continuous supply of bushes in their prime, planting and grubbing must, in an *established* plantation, be done every year. Most growers plant, say, a fifth portion of the ultimate area of lavender aimed at in the first instance and this is repeated each year until the fifth year, when the area first planted is grubbed immediately after flowering and the land fallowed. It is an advantage to have a sixth piece of land available for planting in the fifth year in order to give the land, which has carried lavender for five years, one complete year's rest from the crop. During the first year in the permanent position the plants are better for not being allowed to flower but should be kept trimmed with a pair of sheep shears to promote bushiness.

**Marketing the Crop.**—The lavender is ready for market when the middle blossoms of the spike are widely open; the lower blossoms will then be fertilised and the top blossoms showing the bloom of the bud. When sold as bunched fresh lavender the stalks must be cut as long as possible, cutting well into the bush (this also serving the purpose of cutting back the bush at one operation). The cutting is done by a small sickle having a toothed edge, and should be done as late in the evening as is compatible with despatch for market. Bunches for market are about 12 in. in diameter, tied with raffia as low as possible to the butts. Six of these bunches are tied together in bundles.

When sold as dried lavender the flowers are dried on the stalk and are subsequently removed by hand or with the aid of a sieve. There is a considerable loss of weight during the drying process and only about a fifth of the weight of fresh flowers will be available as the dried product. The lavender is dried by being spread out thinly on shelves in a dry shed for about six weeks.

**Distilling.**—The founding of a lavender plantation for the purpose of oil production is an enterprise which requires careful consideration beforehand. It will be necessary to provide a small distilling plant on the grower's premises unless arrangements can be made for the distillation of his crop at a local distillery.

Beyond reference to the facts that the still should be of the shallow body type and be worked by steam from a boiler the technique of distilling cannot be discussed here. E

When cutting for distilling, the blooms must all be fully out, generally about a week later than for market. The cutting should only be done in the sunshine, the cut laid on clean dry mats, and covered from sun scorch immediately. There must be no moisture in the stook, neither must it be dried up by wind or sun. The mats will be rolled up in the cool of the evening before the dew is falling and carted to the still.

For some purposes the stalks are shortened to about 6 in. before stilling, but generally the whole of the contents of the mat are placed carefully in the still right away.

The grower carts his own lavender to the still, if he possesses no distilling plant of his own, and superintends the boiling and watches for the "Oil-run."

The yield of oil is apt to vary considerably from season to season, as the age of the bushes and the weather will affect both the quantity and quality of the product.

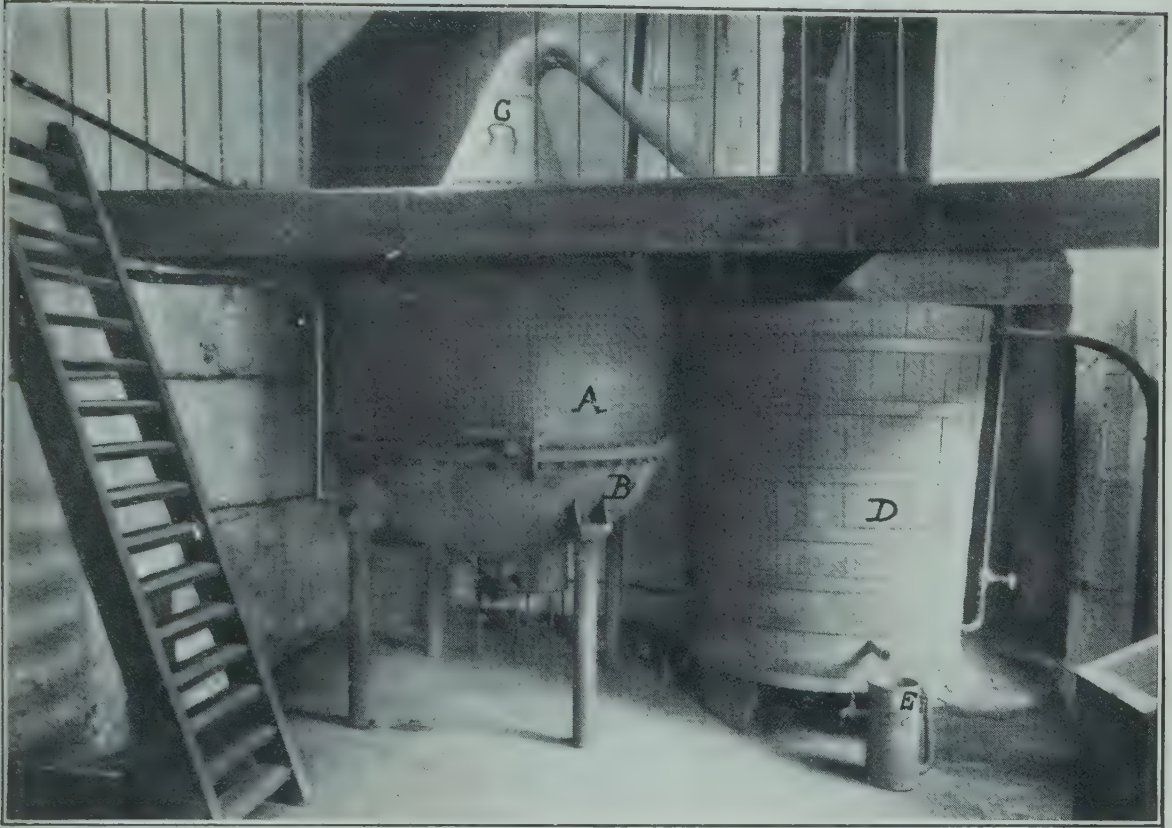
Roughly speaking, 1 cwt. of fresh flowers with six inches of stalk will yield about 10 oz. of oil. An acre of lavender in its prime would in a favourable year yield from 15 to 20 lb. of oil, but taking the whole of the area planted as directed above an average yield of 12 lb. to the acre would be a fair estimate. The market value of the oil is constantly fluctuating and its use in perfumery is influenced considerably by the price of alcohol. It is a noteworthy fact that English oil of lavender enjoys a very much higher value than imported oils.

After distillation the oil is matured in the dark, for from 3 to 5 years, stored in blue glass jars known as "Winchesters" holding about 80 oz., but as this is usually done by the merchants it does not concern the grower, unless he elects to store and mature his own oil.

**Lavender Disease and Pests.**—Lavender is unfortunately often severely attacked in this country by a fungus disease known as "shab" or "wilt," which is caused by the fungus *Phoma lavendulae*. The disease causes wilting or shrivelling of the growths and bushes attacked soon die.

This disease is under investigation at the present time, and at the moment little can be said definitely as to preventive measures. Care should be taken to obtain healthy stocks for planting, and if the disease appears in the plantation all affected portions of bushes and dead bushes should be removed and burnt as soon as detected.





(A) Charge Chamber ; (B) Steam Jacket ; (C) Goose Neck ; (D) Condenser ;  
(E) Receiver.

Although a few growers have installed up-to-date cohobation stills, those usually employed are of simple construction, any fault in the distillate being subsequently rectified by fractional distillation.

The stills are constructed of copper, and generally built to take a charge of about 5 cwt. of flowers at a time. It is important to avoid burning, and the practice is to provide the stills with two chambers, with a perforated false bottom between, the lower chamber being filled with water, which should be as soft as possible.

Distillation is conducted by boiling the water beneath the charge with steam brought from a boiler to a coil, the top of which must be at least 1 ft. beneath the bottom of the charge chamber. The application of direct heat should be avoided. The oil flow from the condenser must be watched for, and complete distillation of the charge usually takes about 6 hours from the commencement of the flow.





On badly drained soils and soils with a deficiency of lime or chalk the roots of the bushes are often attacked by the mycelium of a fungus which penetrates to the main stems and ultimately causes their death.

The exact nature of this disease is obscure but it appears to depend very largely on soil conditions and is not very troublesome where the latter are favourable to the lavender.

No insect or other pests are known to attack lavender to any extent, but slugs often cause damage by eating away the young growths in the early summer.

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## PAYMENTS IN KIND TO THE FARM WORKER.

UNDER varying names, such as "privileges," "perquisites," "extras," "gains," or "allowances," the old custom of making payment for services partly in kind instead of wholly in cash, continues to find favour amongst certain sections of the agricultural community in England and Wales.

The system can be traced back to early times when virgators and cottiers had by law to perform certain labour dues for their lords, for which, it is recorded in the thirteenth century, they "received a considerable part of their income in kind." By the sixteenth century the custom had further developed, and farm servants, and even in some instances day labourers, were allowed to board in the farmhouse, the provision of meals being reckoned as part payment of the worker's wage. Other allowances were frequently given, such as a house and garden, fuel, and especially beer and cider. The system of giving payment in kind gradually decayed, however, towards the end of the eighteenth century. Various causes led to a slow but general development which, with the exception of Northumberland and Westmorland, affected the whole of England and Wales, and by which farm servants were put as far as possible on money wages.

The general economic depression of the early part of the nineteenth century was doubtless considerably relieved by the provision of allotments as part payment. The provision of gardens followed and the tendency towards the payment of wages in kind, but on a more generous scale, was renewed. The Truck Act of 1831, which legislated for the prohibition of the payment of wages in goods or in kind to workers in certain industries,

specifically excluded servants in husbandry from its scope. The system was, no doubt, distinctly beneficial to the workers during the periods of high prices, but as it extended it became open to abuse by unscrupulous employers, and protests were frequent. By the Truck Act of 1887 it was made illegal to contract with a servant in husbandry for giving him intoxicating drink in addition to money wages as a remuneration for his services. This practice, even at the present time, is not extinct, although the custom has generally, except in the cider counties, given way to the payment of "beer money."

During the 10 years 1881-1891 there appears to have been a change for the better in the general conditions of agricultural labourers, partly owing to the increasing tendency to pay wages in money rather than in kind. By 1892 the majority of labourers in the low wage districts had allotments where they had not gardens. Lord Ernle wrote of 1888 that "few cases remain in which the want is not supplied." He estimated that three-fourths of the agricultural labourers, farm servants and cottagers in England and Wales had potato grounds, cow-runs, or field or garden allotments. Housing conditions were also reported to have improved.

From Mr. Wilson Fox's Report\* relating to conditions in 1898 (issued in 1900), it is fairly clear that while the old abuses of the payment-in-kind system had been remedied to quite an extensive degree under the growing demands for payment in cash, the old customs were still largely practised and were dying very hard. In the northern counties the living-in system prevailed amongst married men, and most of the single men lodged and boarded in the farmhouses, frequently receiving as many as five meals a day. Breakfast, dinner and supper were the usual meals, but during harvest light refreshments, such as tea, coffee, milk, bread and cheese, and cake, known as "ten o'clocks," and "four o'clocks," or "lunches" and "drinkings" were provided, and after a few years it became a general practice to give them all the year round. In Yorkshire a similar position was found, the unmarried hired men usually being lodged and boarded ("meated") in the farmhouses or in the houses of the married foremen. The part of their wages due to them in cash was frequently advanced during the term as required and the balance settled on the expiration of the contract. Ordinary labourers received free cottages and potatoes and straw, and coals were carted and in some cases provided free. Northum-

\* Report on Wages and Earnings of Agricultural Labourers. Cd. 346.



berland farmers frequently kept a cow for a worker for about 3s. per week.

The living-in custom prevailed in other areas: Cheshire, Derbyshire, the western side of Herefordshire, Monmouthshire, Shropshire, and Staffordshire, and occasionally in Cornwall, Devonshire and Rutland, although it is pointed out that the practice was rapidly declining in some of these areas. In Wales the greater number of farm workers lodged in the farmhouses or in adjacent outbuildings, or boarded in the farmhouse. The precise methods of providing food and lodging to workers lodging with the farm foreman in Yorkshire and in other areas where the custom existed (North Cambridgeshire, Lincolnshire, Nottingham and Rutland) varied in different counties. Sometimes the men bought their own food, which was cooked by the foreman's wife, while in other cases the foreman received extra wages from the employer or a supply of food such as pork, potatoes, vegetables, eggs, meal, wheat and fuel. The payment in kind to "confined men" in Lincolnshire and to married men in North Cambridgeshire and parts of Nottinghamshire included 20 to 30 stones of pork, several sacks of wheat or flour, and 40 to 60 stones of potatoes in addition to house and garden and the usual benefits. In the south the benefits provided to ordinary labourers were on a less lavish scale. They consisted of the provision of cottages, free or at a low rental, frequently with small gardens, rough firing or fuel carted free, milk, straw for pigs, sometimes potato ground, or potatoes, and despite the passing of the Truck Act, beer or cider, especially during hay and corn harvest. Food also was provided during the special seasons. The custom of giving Michaelmas money (which has since been ruled to be deferred payment of wages) was also largely practised.

In his second report,\* which appeared in 1905 and relates to the year 1902, Mr. Wilson Fox gives tables of the average weekly earnings of agricultural labourers. The author states that "the figures now published for 1902 substantially apply to the years 1903 and 1904." An analysis of the figures shows that the value of payments in kind to farm workers in the south of England ranged up to one-fifth of the total wages. The Board of Trade inquiry† of 1907, dealing with the whole country, shows a greatly reduced proportion, while the figures obtained as the result of the Board of Agriculture inquiry of 1912 suggest

\*Cd. 2376.

† Earnings and Hours of Labour.

a further decrease. In the *Labour Gazette*, July, 1917, reference is made to the Board of Trade figures of 1907, and it is stated that "so far as the Department is aware, the extra earnings (payment in kind, piece work, seasonal payments, etc.) had not varied to any appreciable extent up to the outbreak of war, although their value has probably increased appreciably at the present time."

This was the position when the Agricultural Wages Board was set up under the Corn Production Act of 1917. Unlike the Trade Boards Act of 1909, which made it obligatory on employers to pay the minimum rates fixed by the Board in cash clear of all deductions, the Corn Production Act empowered the Wages Board "to define the benefits and advantages which should be reckoned as part payment of wages in lieu of payment in cash and to fix valuations for such benefits."

Investigators reported very fully on the various practices of giving payment in kind, and showed fairly conclusively that the custom throughout the country had not appreciably changed since the investigation of 1898. In the northern counties and in Wales board and lodging were provided to yearly or half-yearly workers, either in the farmhouse or in the house of the farm foreman. It was found that the most common allowance was a cottage given either rent free or at a low customary rent ranging from 1s. to 3s. per week. The provision of potatoes or potato ground was also extensively practised. In most counties it was customary either to cart coal free from the pit or station or to allow the labourers to use the farmer's cart for carrying the coal in their own time. On colliery farms and in mining districts coal was provided or sold at a small cost, while in Lincolnshire it was reported that coal was given instead of beer at harvest or instead of potatoes. In some areas wood for fuel was given free or hauled free, and labourers in some districts were allowed to collect as much firing as they needed from the coppices and woods. Milk was nearly always given to cowmen and often to other workers. Manure was often allowed to labourers for their gardens or allotments. Bacon and pork were still given freely in Lincolnshire, the East Riding of Yorkshire and Nottinghamshire.

Amongst other allowances given at the time of the inquiry were extra food at harvest or at Christmas, joints when stock-killing, beer or cider (not frequent), rabbits for the catching, and vegetables. Sometimes a worker was allowed to plough his holding or allotment in his employer's time, while the keeping



of an animal for the use of stockmen was not an infrequent custom.

The Wages Board set up two committees: (1) A Cottages Committee, to consider the relation of the value of a cottage provided by the employer in connection with the payment of a minimum wage, and (2) an Allowances Committee, to consider and report what allowances (if any) should be recognised by the Board as benefits which might be reckoned in part payment of wages, and the maximum amount of any deduction in respect of their provision.

On the recommendation of the Cottages Committee the Board decided that a cottage should be recognised as part payment of wages, but that the deduction from the cash wage in respect of the provision of a cottage should not exceed 3s. per week inclusive of rates. In a few areas the maximum valuation for the purpose was reduced to 2s. 6d. or 2s.

The Allowances Committee finally recommended that in addition to a cottage, the provision of board, lodging, milk and potatoes, should also be recognised, the value of any farm produce to be reckoned at the wholesale price in the district. After prolonged discussion the Board accepted the Committee's proposals. Representations were made for the inclusion of potato ground, but it was argued that in view of the complications which would arise in the calculation of the value of any ground (being dependent on the soil, the amount of labour expended, the seeds, and the manure), it would be almost impossible to make any reliable valuation except by dealing with each case individually. Allowances of wood and fuel similarly did not present easy means of assessment and were precluded. The question of the supply of meals and board and lodging raised similar administrative obstacles, but it was realised that the protection afforded by the minimum wage could be weakened and perhaps nullified by the payment of full cash wages and the subsequent deduction of a disproportionate sum for these provisions, and it was therefore decided to recognise the provision of meals and lodging. With regard to the use or grant of stock or the provision of farm grazing, byre room or food for stock, the Board held, despite several objections from the District Committees, that it would not be desirable to include such provisions as recognised benefits, but it was pointed out that there would be no objection to an employer continuing the practice of providing the worker with a cow or sheep or accommodation or food for stock by making an arrangement (apart from the payment

of minimum rates in full) for the worker to pay for the use of stock at the value at which it had been customarily reckoned for that purpose. The custom particularly prevalent in Lincolnshire of supplying bacon or pork could not be recognised, being generally, like potato ground, a deferred and uncertain payment.

It eventually became necessary for the Wages Board to ignore the supply of unrecognised benefits and to insist strictly on payment of wages either wholly in cash or partly in cash and partly by the provision of the recognised allowances of board, lodging, cottage, milk or potatoes, valued at the rates fixed by the Board. This policy probably removed almost all the opportunities of abuse which had existed under the system of giving payment in kind. The system itself was regularised, and the workers were assured of a definite cash wage, the only deductions from which were in respect of certain specified benefits reckoned at fixed valuations.

Had the Wages Board been without power of legislation in respect of benefits and advantages it is probable that the increased value of remuneration in kind during the war would have led to a greater demand for allowances. The action of the Wages Board in confining the benefits which could be legally reckoned as part payment of minimum wages to the provision of a cottage, potatoes, milk, and board and lodging was generally to make these the only benefits provided. In certain instances, farmers continued extra old-time benefits such as fuel, rabbits, manure, vegetables, or straw, and efficient workers were sometimes rewarded by the use of a cow or by an allowance of butter, but it is thought that these additional allowances were quite exceptional.

With the exception of agriculture it has long been illegal under the Truck Acts in almost all industries to make deductions from a worker's wages in respect of goods provided, or to make payment otherwise than in cash, but the Truck Committee of 1908 in their Report make no recommendation for the extension of the Act to include workers in husbandry. From evidence given to the Foreign Office relating to 1907 it appears that in foreign countries and in the colonies agriculture is similarly excluded from any existing legislation as to truck. These facts, viewed in conjunction with the policy of the Agricultural Wages Board (which decided, despite general agreement on the principle of payment in cash as far as possible, to recognise certain benefits in part payment), indicate that the disadvantages and abuses of the system of payment in kind which



obtained in the case of workers in commercial and industrial enterprises, cannot apply to workers in agriculture. On the other hand, if the system is continued on the lines introduced by the Wages Board and now adopted by many Conciliation Committees by which allowances reckoned in part payment of wages are confined to benefits the values of which are easily assessable, it will no doubt continue to suit the convenience of both farmers and workers.

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THE Ministry of Agriculture announces the award of the following scholarships for the sons and daughters of agricultural

**Scholarships for  
Children of Agri-  
cultural Workers.**

workmen and others, in connection with the Scheme established under Section 3 of the Corn Production Acts (Repeal) Act, 1921 :—

*Class I Scholarships, for three years, tenable at University Departments of Agriculture—*

- Mr. F. H. E. Beard, 24, Creswick Walk, London, N.W.11.
- Miss Hilda Broadbent, 7, Moorlands Place, Halifax.
- Mr. David S. Davies, Rhydywenol, Login, Carmarthenshire.
- Mr. Evan E. Edwards, Esgair Farm, Borth, Tregaron, Cardigan.
- Mr. George H. Lyon, Moor Farm, Sleaford, Lincs.
- Miss Annie Newton, 1, Forest Rise, Whipps Cross, E.17.
- Mr. Hugh G. Owen, Tyddyn Burn, Pentraeth, Anglesey.
- Mr. Richard Roberts, Maesgraian, Trawsfynydd, N. Wales.
- Mr. Frank R. Sanders, 23, Malmesbury Road, Chippenham.
- Mr. Reginald W. Smith, 2, Ivy Terrace, Maney Row Green, Holyport, Berks.

*Class II Scholarships, for two years, tenable at Agricultural Colleges—*

- Mr. William C. Collett, Church Lane, Weston-on-the-Green, Bicester, Oxon.
- Miss Margaret L. Edwards, Fwrlode, Llanbedr, Crickhowell, Breckonshire.
- Miss Isabel M. Hudson, 15, Glebe Terrace, Shirbeck, Boston, Lincs.
- Miss Dorothy Kenyon, Mount Oswald, Penmaenrhos, Old Colwyn.
- Mr. Maurice B. Lilley, Wereham, Stoke Ferry, Norfolk.
- Miss Ethel E. Price, Penysheol, Llanishen, Chepstow, Mon.
- Mr. Llewelyn Roberts, Wern Pontlyfni, Llanwnda, Carnarvonshire.
- Mr. Donald Rowe, Garen, Lelant, Cornwall.
- Mr. Sidney S. J. Travers, Hill Top, Kingsdown, Deal.

*Class III Scholarships, for courses not exceeding one year, tenable at farm schools and similar institutions—*

Eighty-nine scholarships have been granted, fifty-six to boys and thirty-three to girls for short courses in agriculture, horticulture, dairying, poultry-keeping, &c.

The occupations followed by the parents or guardians are :—Agricultural workmen, 21 ; working bailiffs, 6 ; small holders, 25 ; market gardeners, 3 ; working gardeners, 6 ; other rural occupations (*e.g.*, harness maker, roadman, estate carpenter, village shopkeeper, etc.), 14. The remaining 33 scholarship holders were bona fide wage-earners in the agricultural industry, and of these the fathers of 23 are dead.

## NOTES ON MANURES FOR SEPTEMBER.

SIR JOHN RUSSELL, D.Sc., F.R.S.,  
*Rothamsted Experimental Station, Harpenden, Herts.*

**General Scheme.**—Before drawing up the fertiliser plan for the year it is necessary to frame a complete scheme of cropping and to decide exactly on what scale this is to be done. Certain crops must be liberally treated if they are to be grown at all, owing to the expense involved in their cultivation; others are less costly and can be treated more or less generously according to the prospects of the market. It is a safe rule that the farmer must be liberal to potatoes owing to the expense of their culture, and to mangolds by reason of the heavy yields they can give. On the other hand, it is unwise to overdo manuring for swedes unless one can expect a crop of 25 tons or more per acre; wheat, barley and oats may be well or poorly manured according to the funds available, but in any case economy in manure is not a wise procedure and is not to be recommended. Perhaps the safest rule that one can give is that if a crop is grown at all it should be grown well.

The basis of the manurial scheme must be farmyard manure and we must repeat and emphasise the advice given previously in these columns, that the manure drawn out into the field and there clamped should be given shelter from rain. A layer of earth 9 in. thick can be put on without great trouble and it saves a good deal of the value of the manure which otherwise would be wasted.

If it appears that there is insufficient farmyard manure to go round the whole of the break to which it is supplied there is the possibility of using various types of town refuse which are now available. Sewage sludge has some value which, however, is easily overrated; but if it can be obtained cheaply and worked easily into the soil it often gives good results. Ashpit refuse is also worth considering: at 3s. or 4s. on the field it is often quite good value to the farmer, though it would not usually be worth more than 6s. per ton. Some of the northern towns send out wastes or manures of considerable value. Manure which contains less than 1 per cent. of nitrogen is not likely to be worth more than about 8s. per ton on the farm.



**Lime and Limestone.**—Having settled the question of farm-yard manure the next point is to decide whether any of the fields want lime. It is comparatively easy at this time of the year to see if lime is lacking. If the clover in the seeds ley tends to fail or become patchy; if swedes and turnips are liable to finger-and-toe; if mayweed has spread among the corn; if dark green patches occur in the meadows and the clover begins to fail; or if any of the other crops become patchy, it is safe to assume that lime is required.

In this case two courses are possible. If no money is available for lime the field should be sown with a crop which can tolerate lack of this substance; of ordinary crops the most suitable are oats and potatoes, but there are also special crops, as rhubarb and celery, that are very suitable. In no circumstances should ordinary clover be sown; if the land must come into seeds, alsike should be substituted.

This, however, is only a temporary expedient and by far the best course is to apply lime. This can be supplied either as ground lime or quick lime, or as ground limestone or chalk. Lime should be used if it is desired to kill insect pests as well as to sweeten the soil, but limestone serves quite as well if the latter object alone has to be secured. There is an important difference in the composition of the two substances: 56 parts of ground lime serve the same purpose as 100 parts of ground limestone, so that if quick lime can be purchased at 30s. per ton the farmer should not pay more than 16s. 9d. per ton for ground limestone or 22s. 7d. for hydrate of lime.

It is usually the arable land that most needs lime; sown grassland often needs phosphates at least as much as lime and therefore should be treated with slag: only in exceptional cases need lime be given as well.

**Manuring for Grass.**—For the manuring of grassland, whether sown or not, it is essential to use phosphates, and these can be given as basic slag, superphosphate or mineral phosphates, whichever is found most suitable. At this season of the year the farmer has a considerable choice; if, however, the manuring of the grass is delayed too long the choice becomes more restricted. If the application is made in autumn some of the slow-acting phosphates, as low-soluble slag or finely-ground mineral phosphates, may be used on grass instead of the more soluble slag or superphosphate: the selection is largely a matter of price. Mineral phosphates should, however, be ground to pass the 120-mesh sieve, and not the 100-mesh sieve

adopted for basic slag. If, however, the manurial application is delayed till the spring the high soluble slag or superphosphate alone should be used.

**The Manuring of Arable Crops.**—In regard to arable crops potatoes and mangolds must, as already stated, be liberally treated; there should be a complete manure, and, in the case of mangolds, a dressing of salt as well. For potatoes a general recipe would be:—2 cwt. sulphate of ammonia, 3 cwt. superphosphate, and  $1\frac{1}{2}$  cwt. sulphate of potash, with farmyard manure.

For mangolds the following may be used:— $1\frac{1}{2}$  cwt. nitrate of soda or nitrate of lime,  $2\frac{1}{2}$  cwt. superphosphate, 3 cwt. French or German kainit, and 2 cwt. salt, with farmyard manure in addition.

These recipes, of course, require modification to suit local conditions. In regard to potatoes, muriate of potash usually gives the same yield as sulphate, but in some cases there is a falling off in quality. Kainit, however, should not be used other than in exceptional cases where it is known to be satisfactory.

Swedes in the south of England may be grown either with dung or with artificials, whichever is the more convenient, though in the drier districts it may be difficult to secure a good plant unless dung is used. If artificials are used they should contain a liberal proportion of phosphates and 1 cwt. or  $1\frac{1}{2}$  cwt. of sulphate of ammonia, nitrate of soda or nitrate of lime.

Corn very often receives nothing in the way of manure, but this is not really a sound procedure. Barley in which seeds are to be sown should receive phosphates—superphosphate in the south country or basic slag in the western and northern parts of England. In some districts it is found that finely-ground mineral phosphates which have gone through the 120-mesh sieve are equally effective and cheaper; this is particularly the case in Northumberland. The advantage of the phosphate is seen in the additional yield or quality of barley and in the better take of the clovers.

**Spring Dressings for Crops.**—Finally, provision should be made for giving the corn crop spring dressings of nitrogenous manures. It is, however, impossible to foretell what dressings would be needed for this purpose, as this is largely influenced by the winter rainfall. A mild wet winter is a time of serious losses of nitrate on arable land, and these have to be made good before the winter corn can start into vigorous growth.



## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending August 8th.				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
Nitrate of Soda (N. 15½ per cent.) ... ..	£ s. 13.10	£ s. 13.15	£ s. 13.10	£ s. 12.17	s. d. 16. 7
„ „ Lime (N. 13 per cent.) ... ..	... ..	... ..	... ..	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 2*	13. 2*	13. 2*	13. 2*	(N)12. 7
„ „ „ neutral (A. 25¾ per cent.)	14. 5*	14. 5*	14. 5*	14. 5*	(N)13. 5
Kainit (Pot. 12½ per cent.) ... ..	... ..	... ..	... ..	1.17	3. 0
„ (Pot. 14 per cent.) ... ..	2. 5	2. 1	2.10	2. 5	3. 3
Sylvinit (Pot. 20 per cent.) ... ..	... ..	... ..	... ..	2.12	2. 7
Potash Salts (Pot. 30 per cent.) ... ..	... ..	... ..	... ..	3.10	2. 4
„ „ (Pot. 20 per cent.) ... ..	... ..	... ..	... ..	2.10	2. 6
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7. 0	2.10
Sulphate of Potash (Pot. 48 per cent.) ...	... ..	... ..	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.) ... ..	... ..	... ..	... ..	3.12§	2. 1
„ „ (T.P. 30 per cent.) ... ..	... ..	... ..	... ..	3. 0§	2. 0
„ „ (T.P. 26 per cent.) ... ..	2.13§	2.10§	... ..	... ..	... ..
„ „ (T.P. 24 per cent.) ... ..	2. 9§	2. 6§	2. 2§	... ..	... ..
„ „ (T.P. 20-22 per cent.) ... ..	... ..	2. 3§	... ..	2. 7§	2. 4
„ „ (T.P. 18 per cent.) ... ..	2. 3§	... ..	1.15§	... ..	... ..
Superphosphate (S.P. 35 per cent.) ... ..	4. 7	... ..	3.15§	3. 7	1.11
„ „ (S.P. 30 per cent.) ... ..	3.17	3. 5	3. 7§	3. 0	2. 0
Bone Meal (T.P. 45 per cent.) ... ..	9.10	9.10†	8.15	8.10	... ..
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7. 2†	6.15	6.10	... ..
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	... ..	12. 5	13.12	... ..

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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## MONTHLY NOTES ON FEEDING STUFFS.

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**Mineral Needs of Farm Stock.**—In previous issues of this *Journal* attention has been drawn to the value of adding mineral mixtures to rations deficient in this respect, and stress has been laid on the necessity for a guarantee when purchasing such mineral substances that they are fit for feeding purposes. Products of this

DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.					
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British -	—	—	12/6	12 10	0 15	11 15	71.6	3/3	1.74
Barley, British Feeding	—	—	9/3	9 5	0 12	8 13	71	2/5	1.29
Danubian „	29/6	400	8/3	8 5†	0 12	7 13	71	2/2	1.11
Oats, English Black and	—	—	9/8	9 13*	0 13	9 0	59.5	3/-	1.61
Grey -	—	—	12/8	12 13	0 13	12 0	59.5	4/-	2.14
Scotch White -	—	—	—	—	—	—	—	—	—
Canadian No. 2	29/6	320	10/4	10 7	0 13	9 14	59.5	3/3	1.74
Western	28/6	—	10/-	10 0	0 13	9 7	59.5	3/2	1.70
No. 3 „	27/3	—	9/6	9 10	0 13	8 17	59.5	3/-	1.61
Feed -	25/9	—	9/-	9 0†	0 13	8 7	59.5	2/10	1.52
American -	28/3	—	9/11	9 18	0 13	9 5	59.5	3/1	1.65
Argentine -	40/-	480	9/4	9 7	0 13	8 14	81	2/2	1.16
Maize, American -	41/-	—	9/7	9 12	0 13	8 19	81	2/3	1.20
Argentine -	—	—	7/6	7 10†	1 11	5 19	67	1/9	0.94
Beans, Rangoon -	—	—	—	—	—	—	—	—	—
Millers' offals :—	—	—	—	—	—	—	—	—	—
Bran, British -	—	—	—	6 0	1 6	4 14	45	2/1	1.12
Broad -	—	—	—	7 0	1 6	5 14	45	2/6	1.34
Middlings, Fine, Im-	—	—	—	9 17	1 2	8 15	72	2/5	1.29
ported -	—	—	—	—	—	—	—	—	—
Middlings, Coarse,	—	—	—	9 7	1 2	8 5	64	2/7	1.38
British -	—	—	—	7 0	1 6	5 14	60	1/11	1.0
Pollards, Imported -	—	—	—	—	—	—	—	—	—
Meal :—	—	—	—	—	—	—	—	—	—
Barley Meal -	—	—	—	9 12	0 12	9 0	71	2/3	1.34
Maize -	—	—	—	11 0	0 13	10 7	81	2/6	1.34
Germ Meal -	—	—	—	8 10	0 18	7 12	85.3	1/9	0.94
Gluten-feed -	—	—	—	8 15	1 6	7 9	75.6	2/-	1.07
Locust Bean Meal -	—	—	—	8 0	0 9	7 11	71.4	2/1	1.12
Bean Meal -	—	—	—	12 7	1 11	10 16	67	3/4	1.78
Fish „ -	—	—	—	16 5	4 6	11 19	53	4/6	2.41
Linseed -	—	—	—	19 0	1 10	17 10	119	2/11	1.56
Cake, English	—	—	—	10 15	1 17	8 18	74	2/5	1.29
9% -	—	—	—	—	—	—	—	—	—
Cottonseed Cake, English	—	—	—	7 2	1 14	5 8	42	2/7	1.38
5½% -	—	—	—	7 0	1 14	5 6	42	2/6	1.34
„ „ Egyptian	—	—	—	—	—	—	—	—	—
5½% -	—	—	—	—	—	—	—	—	—
Decorticated Cottonseed	—	—	—	—	—	—	—	—	—
Meal 7% -	—	—	—	12 0†	2 13	9 7	71	2/8	1.43
Coconut Cake 6% -	—	—	—	8 10	1 10	7 0	73	1/11	1.03
Ground Nut Cake 7% -	—	—	—	8 10	1 15	6 15	56.8	2/5	1.29
Palm Kernel Cake 6% -	—	—	—	5 17†	1 3	4 14	75	1/3	0.67
„ „ Meal 2% -	—	—	—	4 17	1 4	3 13	71.3	1/-	0.54
Feeding Treacle -	—	—	—	5 10	0 8	5 2	51	2/-	1.07
Brewers' Grains :—	—	—	—	—	—	—	—	—	—
Dried Ale -	—	—	—	6 7	1 4	5 3	49	2/1	1.12
„ Porter -	—	—	—	5 17	1 4	4 13	49	1/11	1.03
Wet Ale -	—	—	—	0 17	0 9	0 8	15	0/6	0.27
„ Porter -	—	—	—	0 15	0 9	0 6	15	0/5	0.23
Malt Culms -	—	—	—	8 0†	1 13	6 7	43	3/-	1.61

\* New.

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices :—N, 12s. 7d. ; P<sub>2</sub>O<sub>5</sub>, 4s. 4d. ; K<sub>2</sub>O, 2s. 4d.



nature are now available with this guarantee, and a Mr. F. E. Corrie has prepared a leaflet on "The Mineral Needs of Farm Stock," copies of which can be obtained free on application to Star Cottage, Lingfield, Surrey.

**Fish Meal for Feeding.**—A correspondent has written that the notes on this subject, which appeared in the August issue of this *Journal*, apparently condemned the use of fish meal for live stock. This is obviously not so, as mention is expressly made of the fact that fish meal, of the right kind, fed under proper conditions, is a perfectly sound and wholesome feeding stuff, but that taint will occur if fish meal rich in oil is fed, or if fish meal is fed in excessive quantity.

**Use of Home-Grown Cereals for Feeding.**—In this *Journal*, December, 1922, pp. 780 and 783 two articles were published on the use of home-grown wheat, oats and barley for live stock, and a leaflet was also issued. Farmers have now had time to put the advice contained therein to the practical test, and in view of the probability that a considerable proportion of home-grown cereals will be fed again this year, the writer would be glad if readers will communicate with him giving their experiences, and particularly mentioning any departures from the rules laid down in those articles, which they found necessary. Such letters addressed to the Secretary, Ministry of Agriculture, 10, Whitehall Place, S.W.1, do not require a stamp.

#### FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.E. d.
	£ s.	£ s.	£ s.			
Wheat . . . . .	8 10	0 15	7 15	71·6	2 2	1·16
Oats . . . . .	7 2	0 13	6 9	59·5	2 2	1·16
Barley . . . . .	8 6	0 12	7 14	71·0	2 2	1·16
Potatoes . . . . .	2 2	0 3	1 19	18·0	2 2	1·16
Swedes . . . . .	0 17	0 2	0 15	7·0	2 2	1·16
Mangolds . . . . .	0 15	0 2	0 13	6·0	2 2	1·16
Good Meadow Hay . . . . .	3 18	0 13	3 5	31·0	2 1	1·12
Good Oat Straw . . . . .	2 1	0 6	1 15	17·0	2 1	1·12
Good Clover Hay . . . . .	4 7	1 0	3 7	32·0	2 1	1·12
Vetch and Oat Silage . . . . .	1 17	0 7	1 10	14·0	2 2	1·16

**Use of the Tables.**—The two tables given in this article, and which also appear every month, are intended as a guide to the economical purchase of feeding stuffs. In the large table a comparison is made of the cost per unit of feeding value of the different feeding stuffs offered for sale on the market, and the intending purchaser's attention is drawn to the most economical foods on offer. In the "Farm Values" table, the value per ton for feeding is given for the majority of the home-grown foods on a

strictly comparative basis with the cost of similar foods on offer in the open market. These "Farm Values" are of use when the farmer wishes to ascertain whether to sell his home-grown foods and purchase other foods, or whether to use his home-grown foods.

\* \* \* \* \*

M. PIERRE ALSTEEN gave an account at the International Congress of Agriculture, held in Paris in May last, of the farm competitions held by the Agricultural League of the Province of Namur in 1920 and 1921. The province was divided into six districts according to the quality of the soil, and the competitions in each dealt principally with the crop most typical in it, these comprising wheat, spelt, oats and potatoes. The societies in the district were informed during the preceding winter of the holding of the competitions, and at the beginning of June a first classification of the crops of their members was made by a Committee which was as far as possible unconnected with the district.

In accordance with the results of this first examination three classes of diplomas were awarded to the most successful members of each society. A competition between the different societies was then decided by a further examination of the crops belonging to their members which were placed highest in the first inspection. This was made by a Committee of State Agriculturists and a representative of the League, and money prizes were awarded to the successful societies. Such prizes, which vary from 200 to 750 francs, may not be distributed to their members but used for the purchase of implements for common use, improved seed, demonstration plots, etc. The societies are judged according to the following scale of points:—

Number of members, 10; choice and treatment of seed, 20; manuring and freedom from disease, 20; cultivation and cleanliness of land, 20; appearance of crop and probable yield, 10; skill and knowledge of the cultivators, 10; general results, 10.

In the course of the two years' competitions more than 1,200 fields have been carefully examined by the judges and 91 societies participated.

Great improvements in the methods of cultivation followed have already been noticed. In each district the best farmers are brought into prominence: the best crops are distributed in the district for seed; the use of fertilisers is increasing and cultivation is more carefully carried out.



A FORWARD step of much interest and importance to the fruit growing industry, was taken by the Federation of British Growers, when it decided to hold its annual meeting in a fruit growing district and pay visits to fruit plantations in the neighbourhood. By such visits growers are brought into direct contact with

**Fruit Growing  
and the  
Federation of  
British Growers.**

the methods and views, successes and failures of their fellow growers under conditions which may differ widely from their own, but from which, nevertheless, the most valuable lessons may be learned. More than a hundred growers from the important fruit growing counties met at Cambridge on 29th May for the first of these visits, and the interest displayed and the keen discussion aroused ensure the annual repetition of such a useful event.

The first visit was to the small apple plantation of Mr. J. G. Faircliffe, Burwell, which embodies the results of twenty years' experience in the combination of fruit and poultry. There is little depth of soil over the chalk, and the fruit consists chiefly of Lane's Prince Albert and Worcester Pearmain on paradise, planted 8 ft. apart each way, and closely spur pruned on a long spur system. The plantation is in its thirteenth year and is divided up into pens of 10 or 12 rods each, most of which contain 10 laying hens while the remainder are reserved for chicken rearing. The poultry keep down the grass and no cultivation, spraying or manuring is done. The party was much struck both by the method of pruning and the absence of damage by pests. That the latter was not mere chance was shown by the presence of a moderate supply of the usual varieties of pests.

The party then proceeded to Burwell Fen where the plantations of Mr. R. Stephenson are managed by Mr. Faircliffe. These extend to 85 acres, the land varying from heavy clay at one end to peat at the other. The area was formerly down to asparagus, but is now under apples with some plums. The chief varieties are Emneth Early, Lane's Prince Albert, Worcester Pearmain, Grenadier, Lord Derby, Bramley Seedling and Newton Wonder. The first three are closely spur pruned on Mr. Faircliffe's system, the severity of which may be gauged by the fact that the varieties are almost indistinguishable in shape from each other in winter. The next two varieties are spurred every other year, and the last two are allowed to go except for thinning. The land became foul during the war and

all but 5 acres is now being grazed by pigs, which were started four years ago. No cultivation or manuring is done but the trees are regularly sprayed. In spite of some damage from insect attack and severe frosts, there appeared to be a promise of a fair crop of the earlier varieties. At neither of these places was the foliage up to its usual high standard, but it has to be remembered that the fen winter in May is a serious enemy. The cold store in course of construction near a private railway line was also inspected.

The next visit was to 50 acres of fruit grown on heavy land by Messrs. Robert Ingle, at Kingston. The area was planted 15 years ago with apples, plums, bush fruit and strawberries. The chief interest was centred in the black currants, which had leaves of French type, though the growth of the bush and the fruit was typical of Baldwin. The stock came from France some years ago.

At Croxton Park the party was entertained to tea by Lady Newton in the absence of Sir Douglas Newton, K.B.E., President of the Federation. The fruit farm of nearly 100 acres of heavy clay land has been planted during the last 14 years with apples, pears, plums, bush fruit and strawberries. The visitors were much impressed by the clean condition of the land and still more by the clean condition of the trees, due to early and adequate spraying.

After dinner at Cambridge, Mr. W. G. Lobjoit (Controller of Horticulture) said the Federation was fortunate in having at its disposal the services of Sir Douglas Newton as President and Mr. Seabrook as Vice-President. It was now able to speak with quite respectable weight of numbers in the councils of the nation. He referred to the Federation scheme of grading and packing which the Ministry was assisting through its officers and those of the County Councils. An American grader had been purchased and would be at the disposal of growers. He congratulated them on what had been done and felt there never was a time when co-operation and combination were so essential to deal with commercial questions.

Mr. Seabrook in reply said that Sir Douglas Newton was absent on their business in the House of Commons. The Federation had marked time during the reorganisation, but was now making rapid progress and could be said really to represent the industry. Mr. Stephenson on behalf of the West Cambs. Fruit Growers' Association welcomed the members of



the Federation and regretted that their visit should have taken place in such a bad year.

Early the next morning the party saw a film made on the farms of Messrs. Seabrook & Sons, depicting all the operations of a fruit farm, from the propagation and planting of the tree, to the grading and packing of the fruit and its departure by motor lorry.

The party, conveyed in three char-a-bancs and eleven motor cars, then proceeded to visit some of the smallholders of Cambridgeshire. The plantation of Mr. F. L. Handley, Cottenham, of two acres of strawberries and young trees on heavy wet clay, was greatly admired for its fine tilth and the healthy appearance of the strawberries, which were almost as good as one could wish to see. This was especially remarkable as the land was practically derelict for 4 years while the holder was on active service. Mr. C. T. Chivers, Cottenham, was then visited. This plantation consists of top fruit with gooseberries under, on the famous greensand soil of the district. This was a good sample of the best methods in the district and the freedom from pests, cleanness of the land and promise of a crop were greatly admired.

Another good plantation seen was that of Mr. J. R. Smith, Willingham. Great interest was taken in the young trees of Bramley Seedling, Newton Wonder and James Grieve, pruned under the direction of Mr. A. T. Paskett (Cambs. County Horticultural Adviser).

The next visit was to a young 20-acre plantation, belonging to Mr. J. P. Pentelow, J.P., at Somersham (Hunts). This consisted of young apples, pears and plums pruned under the advice of Mr. F. Tunnington (Hunts County Horticultural Adviser). The under crops were gooseberries, currants, raspberries and strawberries, all doing very well—especially the gooseberries and strawberries.

The party then made for Wisbech where they were welcomed by Mr. W. C. Selby on behalf of the Wisbech Fruit Growers' Association at lunch. Mr. H. V. Taylor (Deputy Controller of Horticulture) expressed the thanks of the whole party to those growers who had so kindly thrown their plantations open to inspection, and Messrs. J. P. Pentelow, J.P., E. Sandall and E. C. Gardiner replied.

A brief inspection was made of the 30-acre plantation of Messrs. Gardiner Bros. Contrary to the usual Wisbech prac-

tice, dessert as well as cooking varieties of apples are grown and the trees are closely spur pruned. Remarkably regular crops are obtained under this system, even on Bramley Seedling.

After tea at Wisbech, the return to Cambridge was made under arctic conditions, so that growers from the west and south thought the Fenlanders must be a hardy race. After dinner Mr. T. W. Attwood, President of the New Zealand Fruit Growers' Federation, gave an informal address. He urged the vital necessity for organisation as the foundation of successful marketing, and growers were especially interested in the method of collecting funds to support the organisation, which is undertaken by Government.

The majority of the party accepted the invitation of Mr. W. P. Seabrook to visit the extensive plantations and nurseries of his firm at Boreham, Essex. On arrival the growers saw an American "Cutler" grader at work, driven by electricity. This is the first machine introduced into this country which grades by weight—the only method which gives perfect satisfaction when the apples are to be packed in boxes. A small hand dusting machine from which the dust is driven out by a revolving fan also aroused great interest. The home plantations consist chiefly of apples, Cox's Orange Pippin and Worcester Pearmain, the latter especially promising a heavy crop. After being entertained to lunch, the party made a tour of the nursery stock. Toppinghoe Hall was then visited where all varieties of hardy fruit are grown, and especial interest was displayed in the black currants and cordon apples.

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THE *Revue de Zoologie Agricole* for August, 1922, contains a full account of the outbreak of the Colorado Beetle in

<p><b>The Colorado Beetle in France.</b></p>	<p>France and the measures that are being taken for its suppression. In view of the danger of its introduction into this country the following summary should be of value to potato growers.</p>
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On 9th June, 1922, M. Mondon, President of the Agricultural Union of Taillon, saw on the leaves of his potatoes numerous red larvæ of an entirely new appearance, subsequently identified as those of the Colorado Beetle. Inquiring further he found that several adjacent fields were similarly affected and that in some the crops were already lost. It was then proved that this pest already existed over an area of more



than 100 square miles to the north-west of Bordeaux. The centre of infestation appeared to be near the village of S  n  jac where the larv   had been seen in July, 1921, and it was supposed that the insect was accidentally introduced at this point in 1919 or 1920 with merchandise imported from America. The development of the affected patch was more accentuated towards the south, and this appeared to be accounted for by the predominance of northerly winds in May and June at the period when the beetles' longest flights usually take place. At the time of discovery the wind had already spread the insect far across the pine region, where the warm and sandy soil seemed specially favourable to it and there were many wild *Solanace  * (plants of the potato family) capable of serving as food for it. It had also spread towards the north, and to the west until stopped by the sea. Road and rail transport may have also done their share in assisting the spread. To the east very little extension was observed.

Many outbreaks were stamped out in a short time by measures varying according to the case, from simple collecting of the insects to the destruction of the crops. Other infested areas, where the only measure undertaken was arsenical spraying, are still not free. Preventive measures were carried out with care in several Communes where equipment for the purpose was set up by the local authorities, but wherever defence measures were left to the initiative of the cultivators they lacked uniformity and were altogether insufficient. By July, 1922, however, a special fund of 500,000 francs was voted by the French Chamber for combating the pest, and regulations were made by the French Ministry of Agriculture (a) prohibiting the importation of potatoes from the U.S.A. and Canada and prescribing the inspection of other vegetables, and (b) prohibiting the transport of potatoes and tomatoes, the boxes, etc., used for carrying them, and also manures, etc., from infected to uninfected districts.

*Control Measures.*—The article goes on to state that the measures that can be taken against the beetle differ according to the firmness with which it has become established. Where, as in the United States, eradication is now hopeless the means available for keeping it in check are (1) the encouragement of natural enemies, (2) insecticides (arsenates or Paris green) applied as a spray or in powder, and (3) cultural practices—winter ploughing to expose the hidden insects, etc.

Previously in Europe the situation has been different. The beetle has hitherto been discovered on a small area soon after its arrival and the object has been to prevent it spreading and to exterminate it as quickly as possible. The affected plot has been isolated; all the perfect insects, their eggs and larvæ, or possibly the whole crop, collected, and drenched with paraffin or benzol; and the soil turned and liberally moistened with the same products.

The outbreak in France, however, presents a new problem. The present infestation when discovered had already spread over an area of more than 100 square miles, and it was therefore too late to take drastic action. A full account is given in the article of the measures now being taken in France. The importation of potatoes from the United States and Canada is prohibited and other vegetables and fruit from the same source are inspected. An infected zone and a protective zone have been delimited, and the transport of potatoes, tomatoes, egg-plants, packages, etc., prohibited. In the protective zone cultivators are required to spray, and in the infected zone to apply any other measures prescribed. Over the whole extent of the territory the declaration of all plots planted with potatoes is obligatory.

It is pointed out that whether there is merely a danger in an uninfected country of the importation of the pest, or whether there is already a considerable infestation, the first essential defence is propaganda, in order to make known to cultivators the appearance of the beetle and its harmfulness, and to bring home to them the necessity of declaring its presence when found and either taking, or submitting to, the necessary remedies. Its existence must be discovered as quickly as possible wherever it occurs, so as to keep the centres of infection as small as possible and enable it to be stamped out. The pest is stated to have been allowed to spread by the ignorance or indifference of cultivators, or even through their evading declaration of its presence, through mistrust of the measures that may be taken to destroy it. The distribution of leaflets with coloured illustrations is advocated, and the exhibition of specimens in a frame on the walls of meeting rooms and local offices. Teachers can also contribute by directing the attention of their pupils to the pictures and inducing them to bring specimens of all insects found in potato fields.





THE following statement deals with the acreage under crops and numbers of live stock in England and Wales on 4th June,

**Agricultural Returns,**  
1923 :—

**England and Wales, 1923.**

The preliminary tabulation of the Agricultural Returns collected on the 4th June, 1923, in respect of agricultural holdings above one acre in England and Wales shows that the total area under crops and grass is 25,941,000 acres, comprising 11,182,000 acres of arable land and 14,759,000 acres of permanent grass. The total area of crops and grass shows a reduction of 85,000 acres on last year's figures, but the area returned as rough grazings is 78,000 acres more than in 1922, so that the net reduction in the area of land coming within the scope of these Returns is thus 7,000 acres. All classes of live stock except horses show an increase.

As compared with 1922, the arable area has fallen by 129,000 acres, while permanent grass shows an increase of 44,000 acres. The reduction in the arable area is mainly accounted for by the corn, pulse and potato crops.

*Cereals.*—The total area under the three chief cereals, including mixed corn, is 5,162,000 acres, or 458,000 acres less than in 1922. All three cereals have declined, wheat by 226,000 acres, barley by 35,000 acres, and oats by 190,000 acres. The area of wheat is the lowest since 1913, but is about the average of the ten years 1905-1914. The barley area is larger than in 1915, but with the exception of that year, is the lowest on record. The area under oats is practically the same as in 1913 and rather larger than in 1914.

*Beans and Peas.*—The area of beans at 234,000 acres and of peas at 141,000 acres, show substantial reductions of 50,000 acres and 32,000 acres respectively on last year's figures. The area of beans is the smallest during the last twenty years, excepting that of 1917, while apart from the war period the area of peas is the lowest on record.

*Potatoes.*—The total area of potatoes 467,000 acres, is 94,000 acres less than in 1922. There has been a reduction in all parts of the country, consequent on the poor financial results of last year's prolific crop, but this year's area is still larger than in any year before the war.

*Roots.*—The area returned as under turnips and swedes is 861,000 acres, this being 40,000 acres more than in 1922. The area of mangolds, however, at 403,000 acres shows a decline of 20,000 acres, but with the exception of 1922 is the largest since 1915.

*Fruit.*—The area of orchards is returned at 232,000 acres or 12,000 acres more than in 1920. Small fruit, however, shows a decline, this year's area of 63,700 acres being 11,000 acres less than in 1922, though it is larger than in the two years 1919 and 1920. Small fruit is grown largely in orchards, and although growers are asked to show figures for small fruit separately in the Return, it is possible that this may not have been done very exactly in all cases.

*Other Crops.*—The area of other crops has, on the whole, declined, this being mainly due to a large reduction of nearly 50,000 acres in the case of vetches or tares. Mustard and lucerne both show relatively large increases, and there is a notable increase in the area of sugar beet, which is twice that of last year. Hops show a decline of 1,600 acres.

*Clover and Rotation Grasses.*—The area of clover and rotation grasses was greatly reduced last year owing to the failure of the 1921 sowings. That loss has now been recovered, and this year's area of 2,601,000 acres is the largest since 1911. The area of these crops which is reserved for hay is 287,000 acres greater than in 1922, which more than makes up the small decline of 58,000 acres in the area of permanent grass for mowing.

*Horses.*—The number of horses on agricultural holdings has again fallen, the total of 1,281,000 this year being 59,000 less than in 1922. The decline in breeding continues, the number under one year old being only 66,000, or 18,000 less than last year.

*Cattle.*—The total number of cattle at 5,822,000 is 100,000 more than in 1922, and is now back to the pre-war level. Cows and heifers in milk or in calf number 2,614,000, or 92,000 more than in 1922, and this year's total is the highest on record. The number of calves is 29,000 less than last year, this, no doubt, being partly due to the heavy fall which was recorded last year in the number of heifers in calf. That fall, however, has practically been recovered this year.

*Sheep.*—The total number of sheep is 13,832,000, or 394,000 more than in 1922, when a fall of practically the same number was recorded. The number of breeding ewes has again improved, this year by 69,000, and the satisfactory prices both for mutton and wool which have been ruling this season may lead to a further increase in flocks.

*Pigs.*—Pig breeding and feeding has been fairly remunerative since last year, and the number of pigs shows the large increase



PRELIMINARY STATEMENT of Acreage under CROPS and GRASS and  
Numbers of LIVE STOCK in England and Wales on 4th June, 1923.

DISTRIBUTION.		1923.	1922.	INCREASE.		DECREASE.	
		<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Per Cent.</i>	<i>Acres.</i>	<i>Per Cent.</i>
TOTAL ACREAGE under all CROPS and GRASS		25,941,000	26,026,000	—	—	85,000	0·3
*ROUGH GRAZINGS .. .. .		4,859,000	4,781,000	78,000	1·6	—	—
ARABLE LAND .. .. .		11,182,000	11,311,000	—	—	129,000	1·1
PERMANENT GRASS {	For Hay .. .. .	4,355,000	4,413,000	—	—	58,000	1·3
	Not for Hay .. .. .	10,404,000	10,302,000	102,000	1·0	—	—
	TOTAL .. .. .	14,759,000	14,715,000	44,000	0·3	—	—
Wheat .. .. .		1,741,000	1,967,000	—	—	226,000	11·5
Barley .. .. .		1,329,000	1,364,000	—	—	35,000	2·6
Oats .. .. .		1,974,000	2,164,000	—	—	190,000	8·8
Mixed Corn .. .. .		118,200	125,200	—	—	7,000	5·6
Rye .. .. .		73,700	84,600	—	—	10,900	12·9
Beans ... .. .		†234,300	285,000	—	—	50,700	17·8
Peas .. .. .		†141,400	173,600	—	—	32,200	18·5
Potatoes .. .. .		466,700	561,200	—	—	94,500	16·8
Turnips and Swedes .. .. .		861,400	821,100	40,300	4·9	—	—
Mangold .. .. .		402,900	422,600	—	—	19,700	4·7
Cabbage, Savoys and Kale .. .. .		72,200	73,300	—	—	1,100	1·5
Kohl-rabi .. .. .		12,900	16,200	—	—	3,300	20·4
Rape .. .. .		77,900	75,200	2,700	3·6	—	—
Vetches or Tares .. .. .		86,700	186,200	—	—	49,500	36·3
Lucerne .. .. .		57,900	50,600	7,300	14·4	—	—
Mustard .. .. .		52,900	39,600	13,300	33·6	—	—
Brussels Sprouts .. .. .		16,900	15,000	1,900	12·7	—	—
Cauliflower or Broccoli .. .. .		11,200	10,500	700	6·7	—	—
Carrots .. .. .		10,100	14,100	—	—	4,000	28·4
Onions .. .. .		2,400	3,600	—	—	1,200	33·3
Sugar Beet .. .. .		17,000	8,400	8,600	102·4	—	—
Linseed .. .. .		8,900	4,800	4,100	85·4	—	—
Hops .. .. .		24,900	26,500	—	—	1,600	6·0
Small Fruit .. .. .		63,700	74,700	—	—	11,000	14·7
Orchards .. .. .		231,900	†220,000	11,900	5·4	—	—
CLOVER and ROTATION {	For Hay .. .. .	1,815,000	1,528,000	287,000	18·8	—	—
	Not for Hay .. .. .	786,000	775,000	11,000	1·4	—	—
	TOTAL .. .. .	2,601,000	2,303,000	298,000	12·9	—	—
BARE FALLOW .. .. .		435,300	405,000	30,300	7·5	—	—

## LIVE STOCK.

	<i>No.</i>	<i>No.</i>	<i>No.</i>	<i>Per Cent.</i>	<i>No.</i>	<i>Per Cent.</i>
Horses used for Agricultural purposes (including Mares for Breeding)	798,000	805,100	—	—	7,100	0·9
Unbroken Horses	207,400	230,600	—	—	23,200	10·1
(including Stallions) { One year and above .. .. .	66,200	83,900	—	—	17,700	21·1
Other Horses .. .. .	209,600	220,900	—	—	11,300	5·1
TOTAL OF HORSES .. .. .	1,281,200	1,340,500	—	—	59,300	4·4
Cows and Heifers in Milk .. .. .	1,974,500	1,934,000	40,500	2·1	—	—
Cows in Calf, but not in Milk .. .. .	269,000	288,600	—	—	19,600	6·8
Heifers in Calf .. .. .	371,000	299,300	71,700	24·0	—	—
Other Cattle :—Two years and above .. .. .	1,018,200	922,900	95,300	10·3	—	—
„ „ One year and under two .. .. .	1,108,000	1,167,100	—	—	59,100	5·1
„ „ Under one year .. .. .	1,081,400	1,110,800	—	—	29,400	2·6
TOTAL OF CATTLE .. .. .	5,822,100	5,722,700	99,400	1·7	—	—
Ewes kept for Breeding .. .. .	5,497,200	5,428,100	69,100	1·3	—	—
Other Sheep :—One year and above .. .. .	2,541,300	2,289,900	251,400	11·0	—	—
„ „ Under one year .. .. .	5,793,300	5,720,000	73,300	1·3	—	—
TOTAL OF SHEEP .. .. .	13,831,800	13,438,000	393,800	2·9	—	—
Sows kept for Breeding .. .. .	388,400	302,000	86,400	28·6	—	—
Other Pigs .. .. .	2,223,000	1,996,900	226,100	11·3	—	—
TOTAL OF PIGS .. .. .	2,611,400	2,298,900	312,500	13·6	—	—

\* Mountain, Heath, Moor, Down and other rough land used for grazing.

† In addition there were 4,900 acres of beans and peas grown for fodder in 1923.

‡ As returned on 4th June, 1920.

of 312,000. This year's total of 2,611,000 is the highest since 1911. The number of sows kept for breeding is 388,000 or more than 25 per cent. above last year's figure, and is the largest recorded since 1895.

ACREAGE OF HOPS.

PRELIMINARY STATEMENT compiled from the Returns collected on the 4th June, 1923, showing the ACREAGE under HOPS in each COUNTY of ENGLAND in which Hops were grown, with a COMPARATIVE STATEMENT for the Years 1922 and 1921.

COUNTIES, &C.					1923.	1922.	1921.
					Acres.	Acres.	Acres.
KENT	...	...	East	...	3,540	4,100	4,010
			Mid	...	5,200	5,530	5,410
			Weald	...	6,710	7,110	6,630
			Total, Kent	...	15,450	16,740	16,050
HANTS	...	...	...	...	1,020	1,070	1,040
HEREFORD	...	...	...	...	3,890	3,950	3,520
SURREY	...	...	...	...	210	220	200
SUSSEX	...	...	...	...	2,270	2,350	2,270
WORCESTER	...	...	...	...	1,950	2,030	1,960
OTHER COUNTIES	...	...	...	...	100	90	90
Total					24,890	26,450	25,130

\* \* \* \* \*

THE Agricultural Organiser for Buckinghamshire (Mr. John Porter, B.Sc.) reports that Yellow Rattle (*Rhinanthus*

Yellow Rattle.

*Crista-galli*, L.) was abundant in the meadows this year, and at one centre the horse-sprayer was used. In addition, plots were laid off to test finely-ground kainit, sulphate of ammonia, etc., applied in the dry state when the leaves were wet.

Where the full-strength sulphate of ammonia spray\* was used the results were highly satisfactory, the Yellow Rattle being killed out. Fortunately, the red clover was very little damaged. With regard to the kainit, etc., applied in the dry state, these were only partially effective. This may be due partly to the leaves of Yellow Rattle not being sufficiently wet to hold the dry powder and partly to imperfect distribution by hand. On those plots where the leaves were sufficiently wet and the distribution was uniform both sulphate of ammonia and finely-ground kainit proved effective in reducing the weed. Yellow Rattle is dealt with in the Ministry's Leaflet No. 251.

\* 2 cwt. to 50 gal. water per acre.



ALL growers of potatoes who wish to sell any part of their produce for seed are reminded that potatoes sold for planting in

**Wart Disease  
of Potatoes  
Order, 1923.**

England and Wales must be officially certified either—(a) as having been grown on land free from Wart Disease, or (b) as having been inspected and found to be free from the disease, or (c) as being of an approved immune variety true to type.

As regards potatoes grown in England and Wales the certificates will be issued by the Ministry. The necessary inspections may be made by an Inspector of the Ministry or by some competent person previously approved by the Ministry.

When potatoes are sold for planting, the seller must furnish the buyer with the number of the certificate relating to the potatoes sold. In order to assist both buyers and sellers of potatoes, it has been arranged that the certificate numbers shall have prefixes as follows:—

C.L. (=clean land) for potatoes grown in clean districts or from crops which have been inspected and on which no Wart disease has been found; and

T.S. (=true stocks) for approved immune varieties which have been inspected and found to be true to type.

The letter A will be used in addition for potatoes grown in an infected area, and the certificates for such potatoes will thus have numbers prefixed by A.C.L. or A.T.S.

Certificates will not be required by a grower who wishes to plant seed saved from the crop grown in the previous year on the same premises.

Growers who intend to sell seed potatoes must make early application to the Ministry for the necessary certificates. Growers of immune varieties should apply for inspection of their crops whilst growing, in order that they may obtain the certificate necessary to enable the potatoes to be planted in infected land. If the crop is not inspected only a "C.L." or "A.C.L." certificate can be issued, and the seed will not be allowed to be planted in infected land. It will be necessary in districts in and near infected areas for crops of susceptible varieties also to be inspected before a "C.L." or "A.C.L." certificate can be issued.

The Ministry will be prepared to arrange for the necessary inspections. the fee for which will be 2s. 6d. per acre or part of an acre. No charge will be made for the issue of certificates where no inspection by the Ministry's officers is entailed.

THERE have been great developments in the poultry industry since the war, and it is being more and more realised that, in view of the enormous imports of eggs and poultry from abroad, there is ample room for its further expansion. In keeping poultry for profit, it should be realised that prices are tending to fall, and it is essential that sound practical and business methods should be adopted if profitable results are to be expected.

**Poultry-keeping:  
Volume of  
Leaflets.**

To assist poultry-keepers and others with the best general advice that is procurable the Ministry of Agriculture has issued its collected leaflets and has included with poultry those on other small live stock, pigeons, rabbits and goats. The information given in these leaflets is based on sound knowledge and experience, but is in most cases only intended to serve as an introduction to the various subjects dealt with. Poultry-keepers in country districts should remember that in most counties in England and Wales there is a County Poultry Instructor who has been appointed to assist poultry-keepers in the county to overcome their practical difficulties. Should the services of the instructor be desired, a communication should be sent to the County Agricultural Organiser, who may usually be addressed at the County Offices. Amateurs in cities and suburban districts are recommended to join the local poultry society, if there is one.

The volume is to be obtained on application to the Ministry's Office at 10, Whitehall Place, S.W.1, price 1s., post free.

\* \* \* \* \*

A ONE-DAY poultry conference will be held at the Midland Agricultural and Dairy College, Sutton Bonington, Lough-

**Midland  
Agricultural  
College Poultry  
Conference.**

borough, on Tuesday, 25th September, 1923. Short papers will be read on "Some Aspects of Poultry Nutrition," by Capt. E. T. Halnan; "Chicken Rearing," by George A. Palmer; "Breeding for Egg Production," by Tom Newman; Naked Eye Characteristics of Diseases—a demonstration by Capt. J. P. Rice. Lunch and tea will be provided at the College. Farmers, poultry keepers, and others interested in poultry keeping are cordially invited to attend. Further particulars can be had on application to the Principal of the College.

\* \* \* \* \*



THE Ministry of Agriculture and Fisheries desires to give notice that new regulations have been issued by the Canadian Government governing the entry of nursery stock and plants into the Dominion. The regulations, so far as concerns produce from England and Wales, come into force on the 1st of September, and may be summarised as follows:—

**New Canadian  
Plant Import  
Regulations.**

The term “ plant ” or “ plants ” includes all members of the vegetable kingdom and any plant or product of a plant. The term “ nursery stock ” includes all plants for ornamental purposes or propagation. Seeds and seed potatoes are not included.

All shipments of nursery stock imported into Canada from this country must be accompanied by a certificate of inspection and a permit must be obtained by the importer. An official certificate must accompany the invoice and a copy of this certificate must be attached to each container. These certificates must be issued and signed by an authorised official, and must state that the nursery stock covered by the certificate has been duly examined by him and has been found apparently free from any pest or disease. Each container must also be clearly marked with the names and addresses of the consignor and consignee and the port of entry; in addition, a declaration showing the quantity, kind and value of the nursery stock contained therein, must be affixed. Nursery stock will only be admitted through the following ports: Niagara Falls, Ont., St. John, N.B., Montreal, Que., and Vancouver, B.C. Nursery stock will also be liable to inspection at the port of entry, and if found to be infected with any pest or disease, to protective treatment or destruction. The importation of nursery stock into Canada through the mails is prohibited. The importation of potatoes is prohibited, as also is the importation of the following species of the genus *Pinus* and horticultural varieties, namely:—White Pine (*Pinus Strobus* L.); Western White Pine (*Pinus monticola* Dougl.); Sugar Pine (*Pinus Lambertiana* Dougl.); Stone or Cembra Pine (*Pinus Cembra* L.); and all other five-leaved species of the genus *Pinus*: all species and varieties of currants and gooseberries (*Ribes* and *Grossularia*) but not including the fruits of the latter, European Buckthorn (*Rhamnus cathartica* L.) and Common or Rust Barberry (*Berberis vulgaris* L.) and their hybrids and horticultural varieties: also all species and varieties of *Berberis* and *Odostemon* (*Mahonia*) susceptible to Crown Rust of Oats and Black-stem Rust of Wheat respectively, including *B. Amurensis* Rupr.; *B. aristata* D.C.; *B. Canadensis*.

*Pursh.* : *B. ilicifolia* Forst.; *B. Lycium* Royle; *B. Nepalensis* Spreng.; *B. Sibirica* Pall.; *O. Aquifolium* Rydb. and all species and varieties of the genera *Pseudotsuga*, *Tsuga* and *Larix*.

The Ministry is prepared to arrange for the necessary examination and certification of consignments on payment of a fee at the rate of 2 guineas per day for each inspector. The minimum fee charged will be 1 guinea. Special arrangements will be made for the inspection of small consignments at the Ministry's office.

\* \* \* \* \*

## REPLIES TO CORRESPONDENTS.

**Feeding Wet Brewers' Grains to Milch Cows.**—D.U. asks whether the feeding of wet brewers' grains to milch cows increases or diminishes the milk or cream.

*Reply* : The use of wet brewers' grains increases the yield of milk, but if fed excessively tends to diminish the percentage of cream contained therein. Information as to the feeding of wet grains is given on p. 3 of Leaflet No. 388.

**Willow Beetle.**—F.W. & S. sent a specimen of Golden Willow attacked by beetles (no other variety damaged) and asked for means of control.

*Reply* : The willow you enclose is badly attacked by the common Willow Beetle, dealt with in Leaflet No. 301.

In regard to measures of control, a thorough spraying with a wash containing nicotine appears to give the best results. A formula for preparing such a spray is given in the Leaflet. It is essential to spray the plants very thoroughly and if beds are rapidly re-infested from neighbouring plantations it may be necessary to spray a second time in order to kill the beetle grubs.

This particular kind of beetle appears to attack almost exclusively rods of the *viminalis* section, seldom if ever damaging such *triandra* varieties as Black Maul or Champion Rod.

**Pests in Grass and Meadow Land.**—T.L.J. asks for information as to pests killing grass in meadow-land, for identification and control measures.

*Reply* : The insects involved are Aphides, or Green Fly, of a different species, but similar to those attacking roses, fruits trees and other plants.

From the specimens enclosed, however it is apparent that the Aphides have been subject themselves to attack by parasites—in fact the parasitised specimens are in the great majority. These can be readily detected as they are the dried, globular bodies attached to the grass and from which the black Hymenopterous flies which have parasitised them are now emerging. These parasitised specimens are quite different in appearance from the green, living Aphides, which have not been so attacked.

The parasites being so much in evidence, it is extremely likely that the greatest amount of damage has now been done and the attack, as such, will have practically died out. Any control measures, therefore, would probably do more harm than good as the beneficial parasites would fall victims in greater numbers than the Aphides, any of which now remaining are likely to become the prey of the first generation of parasites now emerging.



It is highly improbable that the presence of these insects upon the grass would have any deleterious effect upon grazing cattle.

**Lettuce Disease.**—G.C.M. asked early in May for information on a disease occurring in patches among lettuces, and the methods of control.

*Reply:* The lettuce is attacked by the fungus *Marssonia panattoniana*, which is sometimes very destructive, especially in houses. It is much assisted out of doors by, damp muggy conditions—in fact, the same conditions that favour *Botrytis*.

Sulphur is indicated as a preventive, and all cultural conditions that tend towards less moisture and more ventilation are recommended. Growers in America have found using a system of sub-irrigation instead of overhead watering of assistance, but of course this only applies in certain cases. (An article on this disease appeared in this *Journal*, May, 1923, p. 147.)

**Bladder Plum Disease.**—Mrs. M. wishes to know the cause of and the remedy for the Bladder Plum disease, two of her young damson trees being badly attacked, and another slightly.

*Reply:* The Ministry has not published a leaflet on this disease, which does not cause serious damage, though it is said to be common in certain parts of the west of England. In Worcestershire Plum Pockets occur chiefly on the varieties Victoria and Czar, but less frequently on the Yellow Pershore. The Mycelium of the fungus (*Exoascus pruni*) is perennial in the wood, and plum pockets occur each year, though with varying abundance. They are said to be more prevalent when fine warm weather follows the flowering period.

As to control, the only method that can be recommended is to cut out the affected parts. The shoot should be cut out a foot or eighteen inches below the diseased plum, to try and get rid of the perennial mycelium above referred to.

**Currant Clearwing Moth.**—C.W.V. sent in April specimen Red Currant Twigs containing larvæ and asked for the pest to be identified, and what treatment should be applied.

*Reply:* The currant twigs are suffering from the attacks of the Currant Clearwing Moth. The eggs of this insect are laid in the shoots and the caterpillars on hatching bore into the stem, feeding within the pith, and eventually killing the shoot. Treating with caustic winter wash would be of no value as the caterpillars live beyond the reach of any insecticide. The only method of dealing with the pest is to prune away all weakly and dying branches or shoots, the prunings being burnt. In cutting back branches, care should always be taken to cut to healthy wood, that is to say, to cut beyond the ending of the tunnel made by the pest.

**American Sweet Clover.**—D.W. asks for information about this plant.

*Reply:* There is a biennial variety of *Melilotus alba* known in this country as Bokhara Clover. A Canadian strain is referred to in this *Journal*, September, 1921, p. 554. There is also an annual variety, which, under the name of Hubam Clover has lately been attracting considerable attention in America. See this *Journal*, March, 1923, p. 1152. It is recommended that trials of either, if made, should be on a small scale at first.

**Foot-and-Mouth Disease.**—*Yorkshire, East Riding.*—No further outbreak occurred in this district subsequent to that at Skeffling on 29th June last, and the general restrictions on the movement of animals in the locality were withdrawn on 27th July.

*Bedfordshire.*—Following the outbreak on 3rd July at Stevington near Bedford, 16 further cases of the disease have been confirmed in the County of Bedford, the last of which was on 3rd August. All of these were within the area originally scheduled by the Ministry. In consequence it has not been practicable to proceed very rapidly with the modification of the restrictions imposed on the movement of animals in the district surrounding the original outbreak, but the area affected by these restrictions has been reduced to one of approximately 10 miles radius round Renhold, in which parish the majority of the later outbreaks in this county were located.

*Hampshire and Surrey.*—On 25th July a fresh case of the disease was discovered at East Worldham, near Alton, Hampshire, on premises from which animals had on the previous day been sent to Guildford Market for sale. These animals were traced to their destinations (a slaughterhouse in Guildford and a railway truck at Walton-on-Thames) and were found to be also affected with disease. Restrictions on the movement of animals were consequently applied firstly to an area of 15 miles radius round East Worldham, and secondly to an area of 20 miles radius round Guildford, in order to cover the possible distribution of disease from Guildford Market.

As regards Hampshire there have been 8 further outbreaks of the disease within a few miles of the original case at East Worldham, the latest of which occurred on 10th August.

In Surrey there have been no cases of the disease discovered except in the animals which were sent from East Worldham to Guildford Market and are referred to above.

Certain portions of the area surrounding Guildford, which included parts of the Counties of Sussex, Berkshire and Buckinghamshire were released from restrictions on 8th August, and the restrictions have since been removed except in respect of small areas surrounding Alton and Guildford.

**Leaflets issued by the Ministry.**—Since the date of the list given on page 377 of the July issue of the *Journal*, the following leaflets have been revised.

No. 21.—The Warble Fly.

„ 295.—Marketing of Eggs.

„ 366.—The Manufacture of Whey Butter.

*The following Leaflets have been re-written.*

No. 114.—The Scientific Principles of Feeding Poultry.

„ 317.—The Rearing of Chickens.



# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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OCTOBER, 1923.

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## NOTES FOR THE MONTH.

THE Agricultural Rates Act, 1923, received the Royal Assent on 2nd August last, and gives effect to the undertaking given

**The Agricultural  
Rates Act, 1923.**

on behalf of the Government early in the year that further relief should be given to farmers in respect of local rates. It provides that occupiers of agricultural land, as defined in the Agricultural Rates Act, 1896, shall pay in respect of that land one-quarter of the rate in the pound payable in respect of buildings and other hereditaments. The amount by which it is estimated that farmers' rates will be reduced as a result of this concession is £2,750,000 for England and Wales and £480,000 for Scotland. The deficiency thus arising will be made good to the spending authorities by an additional grant from the Imperial Exchequer. The fixed grant already payable under the Agricultural Rates Act, 1896, is left undisturbed, but the new grant is to vary from year to year in accordance with the rise or fall of the rates.

The Act is to be deemed to have come into operation on the 1st April, 1923. Where before 1st September, 1923, a farmer has paid rates in excess of the amount that he is now liable to pay, the excess amount will be deducted from the next instalment of rates, or in certain instances will be recoverable in cash.

The Act is to continue in force until the 31st March, 1925, unless Parliament otherwise determines. Copies can be obtained from His Majesty's Stationery Office, Kingsway, London, W.C.2, price 3d. net, exclusive of postage.

\* \* \* \* \*

At the meeting, held on 11th September, of the Joint Committee of Producers and Distributors of Milk, agreement was

**Milk Prices.**

reached as to the prices to be paid to producers for milk delivered into London during the twelve months October, 1923, to September, 1924.

and as to the prices at which milk would be retailed in London during that period. These prices are as follows:—

<i>Months.</i>	<i>Producers' Price per imperial gallon.</i>	<i>Retail Price per quart.</i>
October, November and March ...	1/5	7d.
December, January and February . ...	1/8	8d.
April to September ...	1/-	6d.

These prices compare with 1s. 8d. per gallon during the six winter months 1922-23 and 1s. per gallon during the six summer months of 1923, retail prices being 8d. per quart during the winter and 6d. during the summer.

Certain changes have been made in the scheme in force last year as regards the quantities of milk to be paid for as liquid and manufacturing milk respectively. For the new season these will be governed by the average quantities delivered during the basic period—the three months December to February. During the six winter months—October to March—the liquid milk price as above will be paid for 95 per cent. of the average quantities delivered during the basic period, the balance being paid for as manufacturing milk. In April, July, August and September, the liquid milk price will apply to 15 per cent. more than the quantity delivered during the basic period, and in May and June to 10 per cent. more. The price to be paid for manufacturing milk will be settled each month and will be 2d. per gallon less than the price per lb. of Canadian and New Zealand cheese.

\*            \*            \*            \*            \*

FARMERS have again had cause for apprehension owing to the number of outbreaks of foot-and-mouth disease which

#### **Foot-and-Mouth Disease.**

have appeared in various parts of England during the past month. The two groups of cases in Bedfordshire and Hampshire which commenced in July were stamped out by the middle of August. Unfortunately, fresh cases occurred on 27th August at Rotherham, and on 28th August at Blackpool. Subsequent outbreaks appeared in Cheshire, having been caused by the unloading at Crewe on 1st September, of animals from Fleetwood which had been indirectly infected by persons who had been amongst the affected animals at Blackpool. Animals from Crewe carried the disease into Buckinghamshire on 7th September, and into Salop (Boschurch) on 11th September. At the same time fresh centres of disease were established without any known origin near Southampton on 4th Septem-



ber, and at Torquay on 5th September, at Old Clee, Grimsby and Whitchurch, Somerset, on 23rd September.

The total number of outbreaks which have been confirmed on and subsequently to 27th August are as follows:—

Yorks. (W.R.) ...	...	1	Devonshire ...	...	4
Lancashire ...	...	12	Salop ...	...	4
Cheshire ...	...	22	Somerset ...	...	1
Southampton ...	...	5	Lindsey ...	...	1
Buckinghamshire ...	...	5			

Searching inquiries have been made by the Ministry into the movements of animals connected with all these outbreaks, and whilst it is still possible that further cases may arise on premises in the close vicinity of existing outbreaks, it is considered that the spread of the disease due to the infection of the loading docks at Crewe in the beginning of September has been checked, and that no further danger need be apprehended of a wider spread of disease arising therefrom. Every effort is being made locally to confine the disease centres within the narrowest possible limits.

\* \* \* \* \*

It is hoped that the Conciliation Committees will shortly be holding meetings for the consideration of rates of wages for the coming winter, and in this connection the Minister has addressed the following communication to the members of the employers' sides of the Committees:—

**Agricultural  
Conciliation  
Committees.**

" I hope that many Conciliation Committees will be holding meetings shortly for the consideration of rates of wages to be paid during the coming winter. Conditions vary in different parts of the country, but no doubt arguments will be brought forward by the labourers' representatives in support of an increase in wages while the representatives of the employers may on their side give reasons against such a decision.

" One point which in the opinion of the Government should be borne in mind by the employers in these discussions is that in the succeeding six months they will receive some substantial relief under the Agricultural Rates Act.

" As you are no doubt aware, this Act, which takes effect as from the 1st April, 1923, provides that an occupier of agricultural land in England shall be liable to pay only one-quarter (instead of one-half as hitherto) of the rate in the pound payable in respect of other forms of rateable property. Farmers will thus directly and immediately benefit as regards their

assessment to local rates, and to this extent will be in a more favourable position than would otherwise be the case.

“ In the course of the proceedings in the House of Commons on the Bill, I stated that the labourer stood to gain by it and that I was convinced that its passage would have the effect of causing wages to rise. Should that not turn out to be the case it will make it much more difficult to pass any further measures designed for the benefit of agriculture as a whole.

“ In these circumstances, I hope that you as the representatives of employers will take this fact into consideration in any discussions on your Committee as to rates of wages.”

\* \* \* \* \*

THE general index number of the prices of agricultural produce increased from 53 per cent. above 1911-13 in July to 54 per cent. above in August. On the whole, **The Agricultural Index Number.** August prices were on the same level as those of April and May, there having been a rise of 3 points from the minimum of June, due in the main to the much higher level of prices for potatoes of this year's crop. As compared with a year ago the general index number is lower by about 8 per cent.

The following table shows the percentage increase in each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ... ..	200	183	75	68
February ... ..	195	167	79	63
March ... ..	189	150	77	59
April ... ..	202	149	70	54
May ... ..	180	119	71	54
June ... ..	175	112	68	51
July ... ..	186	112	72	53
August ... ..	193	131	67	54
September ... ..	202	116	57	—
October ... ..	194	86	59	—
November ... ..	193	79	62	—
December ... ..	184	76	59	—

The prices realised for such of the new crops of wheat and oats as reached the markets during August were considerably lower than those paid for old crop, so that the average prices show an appreciable decline on the month, wheat falling by 11d. and oats by 1s. 9d. per cwt. Wheat averaged 29 per cent. above pre-war and oats 30 per cent. above, as compared with



53 and 59 per cent. above, respectively, in August, 1922, but last year the new crops were rather later in coming on the market. Barley remained steadier, and with some of the new crop of malting quality on the market the average price rose appreciably in the last week of the month. Potatoes show a further rise and early potatoes sold during August in the wholesale markets at 80 per cent. above pre-war as compared with only 14 per cent. above a year ago. Clover hay became appreciably cheaper during August, but meadow hay showed little change, and generally hay realised prices about 34 per cent. above pre-war.

The prices realised for fat cattle were 4d. per stone less than in July, but this reduction was relatively smaller than is usual at this time of the year, and the index figure consequently shows a rise of one point. Fat sheep prices were a shade higher on the month and averaged 76 per cent. above August 1911-13, a rise of 4 points on the month, sheep remaining relatively much dearer than other fat stock. Prices of fat pigs have risen steadily since the middle of July, but the average increase over July was relatively less than usual and the index figure dropped from 54 to 52 per cent. above pre-war.

The demand for the better classes of dairy cows improved during August and prices advanced, and at the end of the month first quality animals in milk were making about £1 10s. per head more than at the beginning of July. Store cattle are usually cheaper in August than in July, and the average decline of about 5s. per head as compared with last month leaves the index figure unchanged at 28 per cent. above August, 1911-13. Store sheep still remain very dear, and realised during August slightly more than double the pre-war price, whilst store pigs, though cheaper than in July, were also more than 100 per cent. above pre-war.

The average contract price of milk remained unchanged in the London and Birmingham areas, but advanced by 3d. per gallon in the Manchester district, so that over all contract prices advanced to 67 per cent. above August, 1911-13. Butter and cheese became appreciably dearer, butter averaging 2½d. per lb. more than in July, and cheese advancing by 11s. per cwt. Butter was therefore 48 per cent. and cheese 67 per cent. dearer than in August, 1911-13. Eggs also advanced more sharply than was usual in August before the war, the index figure showing a rise of 32 points to 68 per cent. above pre-war. Owing to labour troubles at the docks in Ireland, hardly any Irish butter or eggs were on the English

market during August, and part of the increases in the prices of English butter and eggs may be attributed to the consequent shortage of supplies.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN  
THE CORRESPONDING MONTHS OF 1911-13.

Commodity.		1922.		1923.			
		August	Apr.	May	June	July	August
Wheat	...	53	31	37	38	39	29
Barley	...	48	11	16	17	12	9
Oats	...	59	39	42	41	41	30
Fat cattle	...	70	51	53	52	45	46
Fat sheep	...	103	100	103	83	72	76
Fat pigs	...	92	71	72	69	54	52
Dairy cows	...	67	55	50	50	49	51
Store cattle	...	42	29	33	31	28	28
Store sheep	...	114	92	98	114	109	101
Store pigs	...	128	131	126	130	113	102
Eggs...	...	64	37	43	40	36	68
Poultry	...	85	75	77	87	79	61
Milk	...	70	70	63	53	57	67
Butter	...	77	68	40	33	37	48
Cheese	...	51	92	42	44	54	67
Potatoes	...	14	—28*	—28*	—31*	66	80
Hay	...	54	40	41	42	38	34

\* Decrease.

\* \* \* \* \*

THE Minister addressed the following letter to the Secretary of the National Farmers' Union of Scotland on 3rd September,

**The Potato Position.** in answer to correspondence on the question of the Agricultural Tribunal's recommendation that imports of foreign potatoes be permitted only under general licence:—

“ In reply to your letters of the 11th and 28th August with regard to the import of foreign potatoes into this country, I would remind you that this question was very fully discussed at a deputation which I received on the 17th July last of English and Scottish farmers and potato growers, including Mr. Alexander Batchelor, the Vice-President of your Union, and, as I then explained, it would be impossible to secure the necessary Parliamentary sanction this year to your proposal for the restriction of imports of foreign potatoes. I then stated that the Cabinet had given the matter careful consideration and had decided not to propose legislation at the present time to



empower the Government to prohibit the import of potatoes from overseas.

“ With regard to the low prices realised for potatoes in 1922, while imports of Dutch potatoes may have caused the fall in prices last summer to have been more rapid than might otherwise have been the case, there can be no doubt that the main cause of the slump was the abnormal yield of home-grown potatoes. A total production of about 4,000,000 tons from the agricultural holdings of Great Britain is sufficient for the country's needs, whereas the total production last year was about 5,200,000 tons. The total imports from foreign countries into Great Britain and Ireland in 1922 were 171,500 tons, or only  $3\frac{1}{2}$  per cent. of the total production of Great Britain alone, and of these 98,000 tons were early potatoes from France and the Channel Isles which are not generally considered to be competitors with the home-grown crop. Only 35,800 tons came from Holland and practically none came from that country after August, so that it cannot be seriously contended that imports from Holland kept prices at the very low level at which they remained throughout the season.

“ Turning to this year it is true that the total imports up to date show an increase over 1922, but this has been entirely due to the large increase in imports of quite early potatoes from France and the Channel Isles: the imports from Holland have so far proved below the figures for the corresponding period last year. Whereas 7,274 tons arrived from France in the week ending 4th August, the import in the week ending 25th August had declined to 452 tons, from which it may be presumed that the French supply is now practically exhausted and was of the early variety.

“ In addition the area under potatoes for human consumption in Holland is officially reported to be 20 per cent. less than last year, while the yield per hectare is expected to be lower.

“ The Dutch exchange also is against this country, and this in itself would have a deterrent effect in purchasing potatoes from Holland. In fact the imports from Holland up to date ought not to have had any appreciable effect on the price of the British new crop, unless, as has been suggested, growers have been frightened into taking lower prices by reports of large supplies of Dutch potatoes being available or likely to become available at a low price. It is significant that last week it was reported at Hull market, an important market for Dutch potatoes, that the supply was practically finished and that this week no quotations were given.

“ In your letter of the 11th and the accompanying resolution it was suggested that growers were expecting serious losses again this year, but the trend of prices up to date does not appear to confirm that contention. In the wholesale markets of England and Wales prices last week for first quality potatoes averaged £7 11s. per ton for Duke of York and £7 16s. for Sharpe's Express, while King Edwards were £9 per ton, whereas in the corresponding week of last year average prices for the same varieties were £3 16s., £4 and £4 16s. 6d. per ton respectively.

“ Similarly in Scotland wholesale prices realised in the week ending 22nd August for first quality potatoes were from 70 to 100 per cent. higher than for the corresponding week last year, *e.g.*, first earlies at Edinburgh and Glasgow were £7 and £6 13s. per ton respectively and £4 and £3 5s. per ton in 1922. The free on rail prices to producers both in England and Scotland show an even larger increase over last year's figures, *e.g.*, at Wisbech, King Edwards were making £7 to £7 10s. per ton f.o.r. for the week ending 29th August against £2 10s. to £3 a year ago, and these prices are rather higher than the prices for the previous week, while last year at the same time prices were still declining. In Edinburgh first earlies were quoted at £5 5s. to £6 per ton on rail compared with £2 to £2 7s. 6d. per ton on rail at the same time in 1922. Again Dutch potatoes which were only on offer in two markets, Bristol and London, last week were realising £7 to £7 10s. per ton, which is very little below the rate for the best British early varieties.

“ A further important factor in the potato situation is that the area under potatoes in Western Europe is generally lower than the area last year, while a lower yield is also anticipated. In England and Wales the acreage under potatoes has declined by over 94,000 acres (17 per cent.), and although the figures for Scotland are not yet available it is thought that they will also show a decline.

“ It has been suggested that, owing to the depreciated currency German potatoes are reaching this country via Holland, consigned as Dutch, and that this might cause a serious depression of the British price. I have made enquiries on this point and find that the export of potatoes from Germany is entirely prohibited, so that there can be no question of any danger from such a source.

“ In general I think that there is good reason to suppose that the fears of a serious loss again occurring in the potato growing industry this year are much exaggerated.”



## AGRICULTURAL LANDOWNERS.

## II.

THE RT. HON. LORD ERNLE, M.V.O.

**Landowners and the Supply of Cottages.**—Another charge against agricultural landowners is that they provide an inadequate supply of cottages, and destroy independence by attaching their occupation to work on particular farms.

Admittedly there is a lack of cottage accommodation even in purely agricultural areas. But the deficiency is greatest in urban districts where wages are highest; it is smallest in agricultural districts where wages are lowest. In urban areas the building of small houses as a commercial speculation by private enterprise has, for various reasons, been checked. But on agricultural land cottages are very rarely built as a commercial speculation either for sale for profit, or as a remunerative investment. They are built by agricultural landowners because they recognise a duty to house the labour employed on their land. They build them also in their own interest. Without accommodation for the workers farms could not be let. The better the provision of good cottages, the better the class of farmer and of worker that the farm will attract. Apart from questions of water-supply or of distance from school, the sites of cottages are chosen so that men in charge of animals may be on the spot, and that other workers may be as near their work as possible. There are no trams or omnibuses in agricultural districts. This is the reason why the occupation of cottages is attached to employment on particular farms. And the system cuts both ways. A man who removes to work on another farm is reasonably sure to find a vacant cottage near the scene of his labour.

Nor are agricultural workers the only occupants of houses tied to the discharge of a particular duty. Prime Ministers, Chancellors of the Exchequer, First Lords of the Admiralty, all live in tied houses. In rural villages the position is still more common: it is more the rule than the exception. Every tenant farmer, most land agents, all woodmen, keepers, gardeners, rural postmen, policemen, and road-men, lose their local homes, if they lose their local job.

Still the system is not ideal. In towns, men may lose their employment in a particular factory, but they retain their homes. In agricultural districts, workers lose both together: they depend, in most cases, on their employers both for wages and

house. I wish that I could see any practical substitute for the existing system. On the estates on which I worked for many years, the cottages were not let to farmers who sublet to the men they employed; they were let direct to the workers by the landowner. The system gave no greater security of tenure to the worker. When a farmer dismissed a man, the Estate Office always gave the necessary notice to quit. But it had advantages. Workers, I think, liked to feel that one man paid their wages and another let them their cottage. Apart from this sentiment, cottagers found it easier to get repairs done or a smoky chimney corrected, and it made, though slightly, for permanence because no farmer likes to be known to his landlord as unable to keep his men. The system of direct letting by the landowner is more frequently adopted than is generally realised.

I am going to offer for consideration a Return made to the Land Agents' Society in 1914 relating to 22,727 cottages. They are not selected; they are on different properties; and they cover practically all the counties in England and Wales. But in fairness I must warn you that they may not be a perfectly fair sample. They are on large estates, and, however objectionable large estates may be, they are probably better equipped with cottages than most smaller properties.

There are then 22,727 cottages, built by agricultural landowners out of their own money to house the agricultural labour employed on their estates. Of them only 13,200 are occupied by the agricultural workers for whom they were intended. Of these, 5,508, or 41·73 per cent., are let direct by landowners to the occupants. Who occupy the remaining 9,527 cottages? With one class of occupiers everyone sympathises: 3,137 of the houses are occupied by pensioners and widows. Old age pensions have been an immense boon to rural districts. But their value has been greatly enhanced by the kindly feeling which has allowed old people to remain in their homes, either rent free, or at the cheap rates allowed to workers on the estates.

There remain 6,390 cottages built by agricultural landowners, as part of their duty and interest, to house the agricultural labour employed on their estates. They are in the occupation of persons employed by the Government, or by Local Authorities, or by industrial capitalists other than agricultural landowners. All these occupants are brought there in the interest and for the convenience of their employers. If these employers did their duty as satisfactorily as agricultural landowners, and



housed the labour they employ, there would be little or no deficiency of cottages in agricultural districts.

One other point in this connexion may be made. County Councils are now the largest agricultural landowners. On the new holdings created since the war, houses have been generally provided for the small holders. But at the end of December, 1918, County Councils had provided 12,487 holdings. In the case of 2,159, houses had been sold or leased to the Councils. For the remaining 10,328 the Councils had built 609 houses, thus leaving 9,719 of their tenants, so far as they are concerned, homeless, depending on the provision made by others.

It is sometimes said that only a sixth, or 16 per cent., of the cottages in rural districts have gardens of more than an eighth of an acre. That statement is not confirmed by the Return. It shows that out of the 22,727 cottages, 6,350 have gardens of less than an eighth of an acre, and 16,377 have an eighth or more. That is to say slightly over 72 per cent. have gardens of 20 poles and upwards. The fact that so many of the men have gardens at their doors is one reason why the demand for allotments is relatively small in agricultural districts.

Even if it were conceded that some agricultural landowners are not bloated parasites, and that something may be said for the administration of some of their estates, the admission would not meet two other popular charges. One is that they have usurped the rights of the People and, to put it bluntly, are possessors of stolen goods; the other is that the private ownership of land is contrary to the laws of nature and natural rights. These are large subjects. It is only possible to suggest a few points for your consideration.

**Possession of Stolen Goods.**—The origin of private property in land is lost in the mists of antiquity. Possibly it originated very largely in the right of the first comer. When wandering hordes began to settle and cultivate the soil, individuals staked out their holdings, cleared them, and grew their crops. Public opinion recognised their claim to ownership. The right of the first comer is still acknowledged every day. An omnibus is a public conveyance. Everyone has a right, on payment, to a seat. But, as the omnibus fills up, the first comers sit, the later arrivals are strap-hangers. Whether this is or is not the main source of private property in land, most people would probably agree that it has stimulated the progress of civilisation. But, to-day, many think that, whatever its past services, it hinders the evolution of a more

perfect State. That is not my subject. Our question is whether there is any historical evidence that the People ever owned the land of the country. Ask any of the great historians of the University, and they would tell you, and, I believe, unanimously, that no evidence exists of the ownership of land by the community, and that there is, on the contrary, clear evidence in Anglo-Saxon times of estates owned by private persons, and cultivated by tenants both free and unfree, who paid to the owners labour services, or cash or produce, for the use of the land which they occupied and cultivated in common. Under different names, and in varying stages of development, manorial institutions existed among the Anglo-Saxons, if not in the Celtic age, centuries before the Conqueror reduced them to the system which, at the point of the sword, he imposed on conquered England.

On the antiquarian side, the charge, it may therefore be suggested, fails. Private property in land cannot represent a series of encroachments on the rights of the community, unless those rights ever existed, and of their existence there is no evidence. But the charge has also a modern side. To-day the land of the country is occupied in compact blocks by individual farmers who cultivate it by the labour of wage-earning workers. This uniform method of occupation and cultivation has displaced the older system of village farms occupied and tilled by groups of villagers, which may be traced through Norman, Anglo-Saxon, Roman, and, possibly, Celtic times. Whether this displacement of collective farming by individual farming meant a change of ownership is the point under discussion. On the answer rests the charge of robbery. Without dispute, the village open-field farms were occupied in common, cultivated in common, grazed in common. But to substantiate the charge of robbery, it must be proved that they were owned in common by the occupying cultivators.

The change from collective to individual occupation had been in gradual progress since the 13th century. But up to 1750, from a third to half the cultivated land of England was still occupied by groups of village farmers. It was in the reign of George III (1760-1820) that the change proceeded at an almost revolutionary pace. England was fast becoming a hustling manufacturing country instead of an easy-going agricultural country. Population rose rapidly. It shifted from the South to the North, and gathered round the coal and iron fields or the textile factories in densely crowded industrial districts from



which arose the cry for bread and meat. From 1793 to 1815 the demand for food was made more urgent by pressure of war and fear of famine. Under these changed conditions, drastic alterations were needed in village farms. They were self-sufficing, self-supporting units, raising food for the producers but little or no surplus for sale. To feed millions of artisans farms had to be changed from domestic industries for home consumption into factories of bread and meat, on which the new rotations of crops could be introduced, and live stock winter-fed and improved. The village farms were swept away. Economically, the policy succeeded. Between 1760 and 1821 population doubled: so, under improved farming, did production. In 1831-41 the land of the United Kingdom not only fed its additional population, but was feeding 8 million more people than it was feeding in 1714 or feeds to-day. The result is the more remarkable because agriculture had not yet recovered from the collapse which followed the peace of 1815, or profited by the discoveries of agricultural science.

The main features of the village farm were its arable land and its pasture. The former was generally divided into three great unfenced fields. Each year one field was sown in the autumn for wheat and rye; another was sown in the spring for barley, oats, peas and beans; the third field lay fallow. Each arable holding consisted of a bundle of acre or half-acre strips, equally distributed over the three fields, but designedly so scattered that no two strips were contiguous but were sometimes half a mile apart. The bundles of arable strips were held by different titles. Some of the holders were freeholders; others were copyholders holding of the Lord of the Manor on varying terms and conditions; others were leaseholders for lives, for life, or for terms of years; others were tenants from year to year, or at will. To these arable holdings were attached grazing and fuel rights over the pasture and waste, which were enjoyed by the same titles. Freeholders exercised them as part of their freehold; copyholders as part of their tenure; leaseholders and tenants as part of their tenancy. Grazing and fuel rights over the pastures and wastes were also attached to particular cottages. The owner of a privileged cottage exercised them as owner; the tenant of a privileged cottage enjoyed them in virtue of his tenancy and in consideration of the higher rent which he paid. Similar grazing and fuel rights might be acquired by squatters on the edges of the village farm, and legalised by lapse of time.

When Parliament sanctioned the enclosure of a village farm, commissioners surveyed and valued the land, and published an award in which they distributed it among those who proved ownership. Owners received a compact block of land corresponding in value to the scattered strips and grazing rights which they had owned in the village farm. There was no transfer of ownership—only a change in the subject matter owned. Those whose title was temporary and derivative—those, that is, who occupied under some form of tenancy—received no allotment in ownership. The same rule was followed with the cottages. Land in lieu of grazing rights was allotted to owners, not to tenants. Squatters of twenty years' standing were treated as freeholders: if their occupation was shorter their claim was dealt with as an encroachment and disallowed.

The awards of the Commissioners afford the best evidence on the charge of robbery. That small occupiers were opposed to enclosures, that the Parliamentary machinery was defective, that, over so large an area, mistakes were made or injustices done, must be admitted. But the awards show the number of ownership claims that were allowed. Many are in existence; a few have been printed. Twelve miles from Oxford is Steeple Aston where, in 1767, the village farm was enclosed. The award sets out both the new allotments and the quantities of arable land with grazing rights attached which the allottees had owned in the village farm. It deals with 968 acres. Tithe was extinguished by the allotment to the Rector of 156 acres. The remaining 812 acres were distributed in compact tithe-free holdings among 21 owners, according to the quantity and value of the land and common rights that they owned. The Lord of the Manor, Sir Charles Cottrell Dormer, received for his acreage and common rights 83 acres, a smaller area in quantity than he had owned in the farm. Three women are considerable freeholders. Lucy Buswell, in lieu of  $4\frac{1}{2}$  yardlands and common belonging, received 84 acres; Judith Lamley, 56 acres; Eliza Davis, 53 acres. One cottage owner received, in lieu of his rights of pasture, an acre and a half of freehold tithe-free land. It is a question whether these 21 owners would have sacrificed their legal rights for the benefit of neighbours who had none.

One other piece of evidence may be added. A Return of the Enclosure Commissioners in 1876 states that, between 1845 and 1876, 590,000 acres were enclosed. The area was distributed among 25,930 owners. 620 Lords of the Manors received 27,000 acres, an average of  $44\frac{1}{2}$  acres apiece. Owners other



than Lords of the Manor received an average of 24 acres apiece. The remainder of the land was sold to pay expenses. If these two examples stood alone, and of course they do not, they would not confirm the modern charge that the present estates of agricultural landowners originated in wholesale robbery under enclosures. The study of the awards rather supports the conclusion that they were built up by the more prosaic and legal processes of purchase, marriage and inheritance.

Assuming that, neither historically nor legally, can agricultural landowners be convicted of wholesale robbery, there remains the statement that private property in land is contrary to the laws of nature and to natural rights. This is a statement which cuts away at the roots the peaceful evolution of society. It starts the world afresh, and in this destructive force lies its fascination for ardent spirits yesterday and to-day.

**Laws of Nature and Natural Rights.**—If there was a body of laws of nature established by the universal consent of mankind, it would determine many difficulties. By reference to it we could decide what are the moral rights of individuals, and what ought to be their legal rights. But there is no such universal consent, and therefore the laws of nature have settled no controversies and promoted many. Each century has given a different answer to the question what they are. To-day no two communities, no two individuals would return the same reply. Consequently, the natural rights that are supposed to be founded on these unknown laws are only the rights which, in the opinion of the person who claims them, ought to be recognised by public opinion and sanctioned by law. Evidence so vague and contradictory affords no firm foundation for legislative action. Reasoning and proof are still needed.

The plausibility of the statement mainly depends on a confusion between ordinary laws and laws of nature. An ordinary law commands something to be done or left undone. It enjoins or forbids, and thus creates corresponding duties, rights and wrongs. But a law of nature only states facts. "The earth goes round the sun" is a fact, or, if you like, a law of nature. But it enjoins and forbids nothing, and creates no rights, wrongs or duties. The most that can be said is that every living creature possesses powers, faculties and capacities which correspond with the facts or laws of its nature. There is no natural reason why those powers should not be used to the full without regard to any other living creature, and their unfettered exercise is, if you like to call it so, a natural right. But no one necessarily

does wrong if he hinders the exercise of a natural right; it may even be his duty to resist it altogether.

Tigers are carnivorous animals. That is a fact or law of nature, and their powers correspond to the laws of their being. A man, therefore, is the God-given food of tigers. But he has no duty to be killed and eaten; he commits no wrong in resisting. Which kills which, depends on which is the strongest or the craftiest. "Man requires food and drink to sustain life." That is another fact or law of nature. If I, hard pressed by hunger, enter your house and eat your food, I am exercising a natural right, even though you starve. On the other hand, you have the natural right to knock me on the head, and eat your own food, though my starvation is the consequence. Neither tigers nor men do any natural wrong in exercising to the full their natural rights without any regard to others. Morality, mercy, justice, honour do not enter into the sphere of laws of nature. They belong to a different region of ideas. As regards tigers and men, or men and men, the exercise of natural rights means pandemonium, in which the weakest perish and the strongest survive.

Civilisation controls the exercise of natural rights, so that we may live together in progressive communities. For this purpose exist our code of morality, our ideals of honesty and justice, our civil and criminal law, marriage and other institutions. Take an illustration from the House of Commons. "Man communicates thought by articulate speech." That is a fact or law of human nature, and men have the vocal organs corresponding to this law of their being. It is their natural right to use those vocal organs freely, without regard to anyone else. Every member of Parliament, therefore, has the natural right to talk as loudly and continuously as he likes. That would be pandemonium, in which only the loudest voices would be heard. For mutual convenience the members submit to regulations: they forego their natural rights, and, except occasionally, only one member speaks at a time. In innumerable similar ways civilisation intervenes to control the exercise of natural right.

It would seem, therefore, that the peaceful progress of humanity is linked to the control of natural rights. We have recently experienced what the appeal to the laws of nature means. It was by those laws, and on the assertion of her natural rights, that Germany justified her war of aggression. In the public press, on platforms, in lecture rooms, in pamphlets and in less ephemeral literature, the argument was for many years deve-



loped. Germany needed more territory for her growth, and all men have equal natural rights to the use of all land. By conquest or fraud, so it was argued, Great Britain had appropriated a large part of the earth's surface. It is true that we had lavished our blood and our treasure upon our Empire: true that our possession had, in some cases, lasted for centuries; true that round it had gathered the reasonable expectations founded on a long period of quiet enjoyment; true that our exclusive occupation had been recognised in hundreds of international treaties and agreements. What do these things matter? One generation cannot rob another of the inalienable birthright of mankind. It is the natural right of nations as well as of individuals to seize and keep whatever they are strong enough to take. So a great nation turned its back on civilisation, abandoned its restraints, developed what a native writer called "the beast of prey conscience" and, by the brute force of numbers in the field, claimed the unfettered exercise of its natural rights.

The example might well make us hesitate to introduce into our domestic politics that appeal to laws of nature and natural rights which, in international politics, we defeated at the cost of rivers of blood and mountains of treasure. In a country without representative institutions, governed by an autocrat supported by a military aristocracy, the appeal is to numbers in the field and the arbitrament of battle. In a democratic country, with representative institutions, the appeal takes the shape of numbers at the poll, and the decision of the ballot. But in either case civilisation demands that honesty and justice, rather than mere force of numbers, should inspire Governments, and be the touchstone of action, whether international or domestic.

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## THE GRADING, COMPOSITION AND FEEDING VALUES OF WHEAT OFFALS.

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As recently as in 1917, Wood and Adie\* called attention to the circumstances which made it difficult to assign standard compositions and definite feeding values to the various grades of wheat offals. The confusion which had arisen was traceable

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\* See this *Journal*, Vol. XXIII, No. 12, March, 1917.

to two main sources. In the first place, there existed a lack of uniformity in the naming of offals, and it frequently happened that the same name was applied in different localities to samples of offals which varied widely in size of particles and chemical composition. In the second place, there was a great variation in milling practice in different parts of the country, and whereas most of the larger mills separated their offals into four grades, many of the smaller mills were content with a much simpler division.

In order to point the way out of the confusion which had arisen, Wood and Adie collected a number of representative samples of wheat offals from different districts and submitted them to investigation from a twofold point of view, namely, size of particles and chemical composition. As the samples were collected before the issue of the first Milling Order in 1917, the results of this examination may be taken as applying to normal pre-war wheat offals. As a result of sifting trials, it was concluded that where the offals were most completely separated, the division fell approximately into four grades:—

Grade 1.—*Fine middlings*, which did not pass through the silks ranging from Nos. 10 to 14 used for sifting out flour, but passed through silk sieve No. 3 (56 meshes per linear inch).

Grade 2.—*Coarse middlings*, which did not pass through silk sieve No. 3, but passed through wire sieve No. 24.

Grade 3.—*Pollards*, which did not pass through wire sieve No. 24, but passed through wire sieve No. 16.

Grade 4.—*Bran*, which did not pass through wire sieve No. 16.

In many mills, however, the offals were not so completely separated, and samples from these mills consisted of mixtures of two and sometimes even three of these grades. The results showed that, exclusive of the extreme bran grade, wheat offals could be classified into three “pure” grades (as above) and three “mixed” grades on the basis of size of particles.

That this system of classification possessed definite significance was shown by the chemical analysis of samples of the various grades. The average values obtained are shown in the following table, the results being calculated to the dry matter basis:—

TABLE I.

	<i>Protein.</i> per cent.	<i>Fat.</i> per cent.	<i>Carbohydrates.</i> per cent.	<i>Fibre.</i> per cent.	<i>Ash.</i> per cent.
Bran ... ..	15.57	4.53	61.40	12.25	6.25
Pollards ... ..	16.60	5.49	64.03	8.88	5.00
Coarse middlings	18.98	5.81	64.96	6.11	4.14
Fine middlings	18.05	3.94	73.11	2.13	2.77



It will be noted that the different grades are sharply differentiated on the basis of their chemical composition. The fine middlings are richest in carbohydrates, the amount of the latter decreasing continuously as the size of the particles increases. On the other hand, the percentages of ash and fibre increase continuously as the particles increase in size. The fat and protein are highest in the case of the coarse middlings and decrease either as the particles become finer or coarser than in this grade.

It followed from the results of this investigation that the adoption by the milling industry of a simple and uniform system of grading wheat offals would make it possible to assign to each grade a standard chemical composition. In other words, a uniform system of grading according to size of particles would automatically ensure that the chemical composition of middlings, fine middlings, etc., was uniform throughout the country. Moreover, by means of feeding trials, it would further be possible to assign to each grade not only a standard composition, but also a definite feeding value. Such a procedure would be of advantage both to the miller and to the buyer of offals. As Wood and Adie pointed out, it would not actually be necessary to interfere with local nomenclature, provided the offals were sold with a simple designation indicating size of particle.

Before dealing with the present-day grading of wheat offals, it is perhaps advisable to consider the meaning attached to the term "millers' offals" by the milling industry itself. The National Association of Millers was invited in 1913 by the Board of Agriculture to formulate a definition of this term. The following was the result: "That millers' offals, or wheaten offals sold as such, are the products of wheat and of the vegetable substances extracted from the wheats of commerce in the process of cleaning; but the proportion of such extraneous matter shall not exceed the percentage found in the wheats imported into the United Kingdom."

It follows necessarily from this definition that the screenings extracted from wheat, usually amounting to about 3 per cent., may quite legitimately be ground separately and mixed with the offals obtained from the cleaned wheat. As the screenings consist largely of very small berries, together with broken and shrivelled wheat, oats, barley and other seeds, it is clear that the mixed product, when ground, will contain a substantial proportion of material as fine as flour, and this is an important

source of the floury particles which find their way into the finer offals.

An examination of the characteristic grades of offals sold on the market at the present time reveals the interesting fact that important changes have been brought about as a result of official control exercised during the later years of the war. With the valuable co-operation of Dr. A. E. Humphries, of Coxes Lock Mill, Weybridge, it has been possible to make a systematic investigation of a very large number of representative samples of wheat offals. In all, eighty-three samples were collected from thirty-one firms trading in all parts of England and Wales. The firms in question were invited to send a sample of every grade sold in ordinary trading.

As a result of sifting experiments carried out by Dr. Humphries, it was found possible to divide the eighty-three samples into seven main groups as follows:—

TABLE II.

<i>Group.</i>	<i>Size of particle.</i>			<i>Number of samples falling into group.</i>
A	At least 75 per cent.	over No. 10 wire sieve	...	13
B	At least 75	„ over No. 16 wire sieve	...	18
C	At least 75	„ over No. 24 wire sieve	...	14
D	At least 50	„ over No. 56 wire sieve	...	5
E	At least 50	„ over No. 56 wire sieve and at		
	least 25	„ through No. 56 wire sieve	...	28
F	At least 50	„ through No. 56 wire sieve	...	2
G	At least 75	„ through No. 56 wire sieve	...	3

From these results the following points emerge:—

The groups A, B and C are merely sub-divisions of what has hitherto been regarded as one grade of offal, namely, bran. Subsequent chemical analysis confirmed this view. Broad or flaked bran is now produced in large quantities, and this extraction involves a division of straight-run bran. As a consequence, the finer grades of bran sold as medium bran, fine bran and No. 2 bran are obtained.

By far the most striking effect of war-time control, however, is the almost complete disappearance of the grade of offals formerly known as pollards. No sample was received which bore the designation pollards or corresponded with the grade of pollards tested by Wood and Adie in 1917. The term still appears to be used in a very few districts, and it is still also applied to some of the offals imported from the Argentine, but for all practical purposes, it can be said that control destroyed



the grade. It is probable that some of this product now finds its way into the fine brans and some, after regrinding, into the middlings. The samples of Group C, for instance, probably contain a proportion of this material, although chemical analysis, together with the fact that these samples only pass in part through the No. 16 wire sieve, establishes the offals in this group definitely as brans.

An examination of the detailed sifting returns for the samples in Group D revealed the fact that they cannot be regarded as constituting a typical or "pure" grade of offals, but rather as a "mixed" grade, intermediate between the finer brans and middlings. Since only five out of the total of eighty-three samples fell into this group, it was felt that no useful purpose could be served in taking them into account in feeding experiments designed to establish the food values of typical grades of offals.

The Group E offals may be taken as representing the average middlings now being produced in this country. The E and F groups differ in respect of the presence of a large number of finer particles in the F samples. Since the latter, however, represent such an extremely small fraction of the offals made and sold in this country, they can, like those of the D group, be left out of consideration when selecting typical grades for feeding trials.

The offals in Group G approximate to the old fine middlings and possess a special interest, although they constitute only a small portion of the total offals made in the country. Two of the samples came from South Wales, and the third from South Devon. In South Wales there is a great demand for high grade flour, whilst the demand for lower grade flours is correspondingly poor. In practice this results in a low extraction of flour from the wheats and the appearance of much low grade flour in the offals. As much as 48 per cent. of these very fine offals will pass through the No. 10 silk sieve. In other words, about half of this grade of offals is in reality low grade flour, and it would be possible to utilise these samples in the making of dog biscuits.

The next stage in the investigation concerned the chemical composition of the various groups of offals. Instead of submitting the whole of the eighty-three samples individually to analysis, composite samples representative of the seven groups were made up, each one containing a correct proportion of the original samples in the groups. The seven composite samples

were then analysed by Mr. A. J. Codling in this Institute with the following results, calculated to the dry matter basis :—

TABLE III.

<i>Group.</i>		<i>Fat.</i> per cent.	<i>Protein.</i> per cent.	<i>Carbohydrate.</i> per cent.	<i>Fibre.</i> per cent.	<i>Ash.</i> per cent.
A ...	...	5.19	16.32	60.86	11.01	6.62
B ...	...	5.30	16.38	60.84	10.87	6.61
C ...	...	5.41	16.35	60.90	10.85	6.49
* D ...	...	5.99	17.75	61.41	9.23	5.62
E ...	...	5.68	18.21	65.61	6.28	4.22
F ...	...	5.60	17.24	66.44	6.48	4.24
G ...	...	4.62	19.52	70.56	2.48	2.82

It will be seen that little difference exists between the results for Groups A, B and C, the denomination of these groups as differing grades of one offal, namely, bran, being thus confirmed. The intermediate character of the Group D offals between bran and middlings is brought out by the figures, as is also the resemblance between the groups of middlings, E and F. The results for Group G lead one to anticipate a high feeding value for these very fine offals.

A study of the sifting results of the eighty-three samples, together with the results of chemical analysis of the seven composite samples, leads to the conclusion that present-day wheat offals may be divided into three main grades, namely, Brans (A, B and C), Middlings (E and F), and Fine Middlings (G). It is of interest, therefore, to compare the analytical results for the following three typical grades :—

TABLE IV.

<i>Grade.</i>		<i>Fat.</i> per cent.	<i>Protein.</i> per cent.	<i>Carbohydrate.</i> per cent.	<i>Fibre.</i> per cent.	<i>Ash.</i> per cent.
B Bran ...	...	5.30	16.38	60.84	10.87	6.61
E Middlings ...	...	5.68	18.21	65.61	6.28	4.22
G Fine Middlings		4.62	19.52	70.56	2.48	2.82

It is very clear from the above figures that the classification based on size of particles very efficiently separates the offals into grades which possess sharply differentiated chemical characters. The fine middlings show a high content of carbohydrates, as would be expected from the fact that they contain a large proportion of low-grade flour. The percentage of carbohydrates decreases continuously as the size of the particles increases. The fibre content displays a continuous variation in the reverse sense, being very low in the fine middlings and highest in the bran. A precisely similar variation characterises the ash content.



The amount of protein increases continuously as the size of particle diminishes. In respect of the fat constituent, the percentage is highest in the middlings, and decreases as the particles become either finer or coarser than in this grade. It will finally be noted that the above findings are in substantial agreement with those obtained by Wood and Adie in their work on the composition of pre-control wheaten offals.

Since wheat offals, as made at the present time, had thus satisfactorily been divided into three main typical grades, it now became necessary to carry out digestion trials on samples of these grades. It was hoped in this way to correlate size of particles not only with chemical composition but also with feeding value, and thus to encourage a universal production of offals on a simple and uniform basis. In deciding to continue the investigation in this direction, account was taken of the fact that the milling industry had been out of control for some considerable time, and that the present position as to the grading of offals is one which is likely, substantially, to continue so long as wheat and offals possess approximately the same relative values.

It is not necessary in this article to go into the method of experiment by means of which the digestibility and feeding value of a foodstuff are evaluated. The technique of this part of the work will be discussed fully elsewhere. It may, however, be mentioned that the trials were carried out in duplicate, and wether sheep were employed for the purpose. The offals being tested were fed in weighed amount, together with definite weights of linseed cake and chaffed meadow hay.

Two separate trials were carried out with bran, in order to compare ordinary bran with broad bran from the feeding value standpoint. Broad bran is ordinarily obtained by sifting out the largest flakes from straight-run bran, the remainder constituting medium bran or fine bran. From the broad bran practically all the dusty material has been removed. It is sometimes the practice to pass bran between smooth rollers. In this way "curly bran" is flattened, and the effect may be intensified if the bran is steamed immediately before rolling.

A considerable number of feeders prefer the larger flakes, and, consequently, the miller can command a better price—from 15s. to 35s. per ton more—for the broad bran. It is claimed that broad bran makes a better mash for stock and a

more bulky feed when soaked. Horses are said to prefer it and to do better on it, although its analysis does not differ materially from that of ordinary bran.

The broad bran tested in this experiment had been obtained by the simple sifting of straight-run bran. The main object of the comparison was to ascertain whether, from the standpoint of food value, there existed sufficient justification for the higher cost of broad bran and for the extra labour involved in effecting this division of straight-run bran.

For the purposes of the middlings feeding experiment, a large composite sample was made up, representative of the twenty-eight samples in Group E and the two samples in Group F. The whole sample was thoroughly mixed up in a suitable machine.

The sample of fine middlings was prepared so as to be representative of the finest offals obtained from the three representative firms conducting business in South Wales and South Devon.

The tables which follow summarise the results of the investigation into the feeding value of these various grades of offals. The results of simple analysis of the foodstuffs are given in Table V. The only new point which arises from this table lies in the results for the two brans, which display marked similarity. The ordinary bran appears to be slightly richer in protein and carbohydrate, but somewhat poorer in respect of fat. This difference is probably occasioned by the presence of fine particles in the ordinary bran.

TABLE V.

COMPOSITION OF WHEAT OFFALS USED IN FEEDING TRIALS.  
(Calculated to dry matter basis.)

		<i>Broad bran.</i> per cent.	<i>Ordinary bran.</i> per cent.	<i>Middlings.</i> per cent.	<i>Fine middlings.</i> per cent.
Protein	...	16·86	17·32	18·38	19·64
Fat	... ..	4·59	4·44	5·67	4·83
Carbohydrate	...	59·83	60·71	66·05	70·16
Fibre	... ..	11·86	10·87	5·69	2·62
Ash	... ..	6·86	6·66	4·21	2·75

In Table VI are given the results expressing the so-called digestion coefficients of the constituents of the various grades of offals. By the term digestion coefficient is meant the number of parts of a constituent which are digested and utilised by the animal per 100 parts of that constituent consumed. In every case the figures represent the mean of the values obtained for the two sheep.



TABLE VI.  
SUMMARY OF DIGESTION COEFFICIENTS.

	<i>Broad bran.</i> per cent.	<i>Ordinary bran.</i> per cent.	<i>Middlings.</i> per cent.	<i>Fine middlings.</i> per cent.
Dry matter ...	57·9	57·0	71·5	75·8
Organic matter...	61·6	60·9	75·4	78·2
Protein* ...	75·3	72·3	72·7	74·0
Fat ...	71·0	71·0	86·0	88·3
Carbohydrates†	62·7	63·5	78·2	80·9

\* Protein (corrected) 88·3      87·0      90·0      91·0

† Including fibre.

It will be noted that the digestion coefficients for the constituents of the broad bran and ordinary bran display quite good agreement, leading to the conclusion that there is little to choose between the two brans from the feeding standpoint.

The figures for dry matter, organic matter, fat and carbohydrate show clearly a progressive increase in the digestibility of these constituents with decrease in the size of the particles constituting the offals.

This behaviour, however, is not displayed by the values of the protein digestion coefficients, and there can be little doubt that the protein of bran is almost as digestible as the protein of middlings and fine middlings.

In Table VII are tabulated the percentages of digestible nutrients in the different classes of offals. The results are arrived at by combining the data of Tables V and VI. The starch equivalents for maintenance and production and the nutrient ratios are also given.

TABLE VII.  
AMOUNTS OF DIGESTIBLE NUTRIENTS AND FEEDING VALUES.

	<i>Broad bran.</i> per cent.	<i>Ordinary bran.</i> per cent.	<i>Middlings.</i> per cent.	<i>Fine middlings.</i> per cent.
Protein ...	12·69	12·52	13·36	14·53
Fat ...	3·26	3·15	4·88	4·26
Carbohydrate* ...	44·91	45·45	56·10	58·88
Maintenance starch† equivalent (lb.)	68·27	68·35	84·02	86·84
Production starch † equivalent (lb.)	49·09	49·20	67·95	79·12
Nutrient ratio‡ ...	4·12	4·19	5·02	4·71

\* Including fibre.

† Per 100 lb. dry foodstuff.

‡ This figure gives the number of pounds of digestible carbohydrates and fats (fuel substances) which go with one pound of digestible protein (repair substance) in the foodstuff.

The results in Table VII very clearly substantiate the conclusion already arrived at, namely, that the two brans are

equal from the feeding point of view, and that the difference in price between the two foodstuffs cannot be justified on the grounds of feeding value.

The data further emphasise the statement made earlier in this communication, namely, that a simple uniform method of grading offals on the basis of size of particles yields grades which are characterised by a perfectly distinctive chemical composition (both in regard to crude and digestible constituents) and also by the possession of well defined feeding values.

The values of the starch equivalents are throughout higher than those attributed on somewhat speculative grounds to wheat offals by Wood and Adie. The latter investigators did not possess at the time any reliable digestibility data on which to base their calculations.

Attention should be directed to the excellent feeding value possessed by the fine middlings. From the feeder's point of view, it is to be regretted that so little of this class of offals is made in this country at the present time.

In conclusion, the writer would like to tender the thanks of the Institute to Dr. A. E. Humphries for his co-operation in the carrying out of this investigation.

\* \* \* \* \*

## BARLEY GROWING.

H. HUNTER, M.Sc.,

*Ministry of Agriculture for Northern Ireland.*

BECAUSE of its particular suitability to medium and light classes of soil, its value as a spring-sown crop and the facility with which the produce can generally be disposed of, barley continues to hold an important position in the ordinary farming rotation of a large portion of the country.

**Soils.**—Barley grows best on well-drained medium to sandy loams, with gravelly sub-soils, or in other words on free working, open, readily-drained soils, and the greater acreage of the crop in England is found in the eastern and southern counties, where soil conditions such as those described prevail. In the northern counties the area under barley is considerably less than in the south, owing both to the heavier soil there prevailing and to the later seasons and consequent tendency of the grain to ripen insufficiently. Even in these counties,



however, the selection of earlier ripening varieties for cultivation would tend to minimise the effect of these natural conditions.

**Points of Good Malting Barley.**—The points of good malting barley are :—(1) Good condition; by which is meant dry, well-handling grain, free from any smell of heating or of mould and with no trace of growing grains; (2) bright colour; (3) absence of cracked or skinned grains and of grains of which the germ has been injured or removed in thrashing; (4) evenness in size of grain; (5) finely wrinkled skin, which denotes good ripening; (6) the grain when cut across should exhibit a white, mealy surface.

It is recognised that soil and climate play an important part in determining the colour and quality of the grain, but with care in harvesting and thrashing many lots of grain which would otherwise be described as of medium quality, can be so improved as to obtain higher prices in the market than they do at present. Evenness in size of grain is a striking feature to the eye, and a little extra care in screening will secure this condition and so increase the selling value of a sample by several shillings per quarter. It is better to have a little good corn in the screenings than a little screenings in the good corn.

**Cultivation.**—Barley usually succeeds the root crop or another corn crop, its position in a rotation being determined to a large extent by the state of fertility of the land. For two reasons too high a state of fertility is undesirable for this crop: (a) on rich soil the straw is liable to be overgrown and will probably become laid with heavy rain, and (b) because with overgrowth of straw the grain tends to be thin and “steely” and thus unsuitable for malting.

The cultivation operations, after both roots and stubble, are very simple. The stubble land should be ploughed in autumn or early winter, and the root land immediately the last roots are either carted or eaten off. Once seeding time approaches, a cultivator may be run over the land or, failing this necessity, an ordinary harrow only.

The points to be remembered at this stage are that barley is a shallow-rooted, quickly-growing plant, and to obtain evenness in the composition of the grain—an important condition in malting barley—all cultivation operations should be performed so as to obtain the greatest uniformity possible.

**Sowing.**—The seed bed should be fine and dry and the seed deposited in the soil at regular depths and distances. It is desirable to sow barley with a seed drill, and, as a general rule, the distance between the rows should not be more than is absolutely necessary. The usual width of drill is 6 in., but on some soils good results are obtained at  $4\frac{1}{2}$  in.

While it is inadvisable to sow too deeply, shallow sowing should also be avoided as the plants do not then obtain a sufficiently secure root hold, and with heavy rain and wind will lodge the more readily.

The quantity of seed used varies considerably with the class of soil and the time of sowing, and is affected also by special conditions, such as the existence of large numbers of rooks in the immediate neighbourhood, or the known liability to severe attacks of wireworm and leather jacket. As a general rule  $2\frac{1}{2}$ -3 bushels is sufficient, but on very light soils this quantity may be slightly increased. When early spring sowing is practised, and still more with autumn sowing, heavier seeding is advisable.

The date of sowing is important. Provided the land is dry and a good fine seed bed can be obtained, the earlier in the season that barley is sown the greater will be the standing power of the straw and the higher the yield and quality of the grain. Granted such soil conditions, February is not too early, and it is frequently noticed that the weather in that month is more favourable than in March, and a good seed bed consequently easier to prepare.

**Spring Treatment.**—Treatment after sowing is of the simplest description and consists of light harrowing and rolling as soon as the plant commences stooling or tillering. If the crop is attacked by wireworms or leather-jackets, it may be necessary to repeat the rolling at intervals until the attack of these pests ceases or the plants grow too strong to suffer from them.

Charlock, an extremely objectionable weed, is sometimes very abundant in barley fields, and efforts should be made to eradicate it by spraying with copper sulphate. Details as to this method will be found in the Ministry's Leaflet No. 63.

If thistles and docks are present to any extent they should be removed by spudding as early in the season as is practicable.

**Manuring.**—When barley is sown after a root crop, the land is usually sufficiently rich with the residues of the manures applied to that crop, and the question of further manuring at this stage does not arise.



When sown after another corn crop, however, it is frequently necessary to apply some artificial manure. Unless the particular requirements of the soil are known beforehand, it is safest and most economical to apply a complete dressing, that is one containing nitrogen, phosphate and potash. A dressing which has proved useful is:—

	1 cwt. Sulphate of ammonia per acre.	
2-3	„ Superphosphate	„
2-3	„ Kainit	„

As barley is a shallow-rooted quickly-growing plant it requires its food material in a readily available form. Thus, of nitrogenous manures, those containing nitrogen in a soluble form are preferable to more bulky and slower acting ones, and the same remark applies to the phosphates, in which case the soluble form, superphosphate, is recommended.

On wold and chalky soils generally, nitrate of soda is sometimes preferable to sulphate of ammonia, when the same quantity in the mixture, namely, 1 cwt., is sufficient. Both of these manures should be used cautiously as they encourage straw development and tend to produce “steely” instead of the “mealy” grain desired by maltsters. In association with phosphates and potash, however, this tendency is very much reduced, and the quantities recommended above can then be usefully and economically employed.

The mixture of artificial manures should be applied to the land previous to sowing and immediately after mixing, when the harrowing before and after the seed-drill will incorporate it thoroughly with the soil.

On occasion it is necessary to apply some stimulating manure to assist the plant over a severe attack by leather-jackets or wireworms, and  $\frac{1}{2}$  to  $\frac{3}{4}$  cwt. (but not more) of nitrate of soda or sulphate of ammonia may be used as a top dressing.

When a field is known to be very rich and lodging is feared, a dressing of 2-3 cwt. of superphosphate may be applied at sowing time. This will hasten ripening, and at the same time stiffen the straw and assist materially in filling the grain.

**Harvesting.**—The actual harvesting operations of the barley crop are very much the same as those employed in the case of wheat and oats. Unlike these two crops, however, barley requires to be fully ripe and all traces of greenness should have disappeared completely from the straw and grain before it is cut. At this stage the grain is quite hard and should exhibit a finely wrinkled skin.

The length of time in the stook or shock will depend somewhat on the weather, and on the extent to which the butts of the sheaves are free from weeds. So far as it is practically possible everything in the sheaf should be thoroughly "killed" before carrying, as the chances of heating in the stack are greater with barley than with other cereals and the results are more serious. There is generally a slight natural heating in the stack, which, provided it does not proceed too far, matures the grain and is to this extent beneficial. All traces of sweating should have disappeared, however, before thrashing, otherwise the grain will exhibit an indifferent colour and will handle badly.

**Thrashing.**—Thrashing is one of the most important operations in handling the crop, and, as considerable damage may be done at this stage, more than usual care is urged upon growers to prevent unnecessary depreciation in the value of their grain.

The best of the barley crop is used for malting, and its commercial value for this purpose is considerably higher than for any other. Consequently, almost every grower endeavours to reach this standard, and it should only be necessary to point out some of the obvious causes operating against him to secure their correction.

Malting barley is valuable on account of the starch it contains, but this cannot be utilised by the brewer until it is converted into a sugar called maltose—a change brought about in the grain during the early stages of growth of the young plants. It is thus absolutely necessary that in malting barley the germ should not be removed or injured in any way during thrashing. In addition, when any portion of the skin of the barley corn is removed the grain is liable to mould on the malting floor and thereby impart a disagreeable flavour to the malt. Unfortunately grain exhibiting these features is met with frequently, with the result that the buyer either refuses to purchase a sample exhibiting these defects or offers a much reduced figure for it.

One of the principal causes of such maltreatment is the rapidly revolving drum of the thrashing mill, which when set too close to the breast (or concave perforated screen between which and the drum the straw and attached grain passes) will break or skin the grain or remove the germ from it. The thrashed corn should be examined immediately the thrashing mill is working at full speed, and when damage is detected the breast should be set at a greater distance from the drum, an easy alteration for an experienced machine driver to make.



Apart from direct damage done as a result of a badly set drum, skinned and broken grain may be caused by over-feeding or by passing quantities of loose grain through the machine, or, again, by the feeder not opening the sheaves sufficiently before they reach the drum. These are all small errors that can be detected readily and rectified without any serious trouble.

Damage is occasionally caused by the hummeller, but the fault here does not lie so much with this portion of the machine as with too heavy feeding, when the hummeller-case becomes choked with grain, thereby resulting in excessive friction of one grain against another.

The tendency to over-thrash, that is, to thrash the grain too closely, is probably a result of the demand for grain of a high bushel weight—a relic of times when the quality of malting barley was judged in this way. This standard is changing, and to-day the buyer places more importance on the uniformity of size of grain and good thrashing, and grain with a small portion of the beard adhering is valued more highly than closely thrashed material.

Bad screening is frequently the result of over-feeding the machine and should be avoided as it operates against evenness in size of grain.

**Seed.**—The essential character of good seed is that it will grow and produce strong, healthy plants, and it is imperative that farmers before sowing should make themselves sure of the value of the seed they propose using; further, not only should the seed be capable of growing, but it should do so vigorously.

Another point here arises of special application to barley: varieties do not all behave alike on the malting floor; some grow to the length necessary to effect the changes of starch into maltose quicker than others, whilst others require slightly different treatment in regard to the amount of water used or in the extent to which they are turned on the floor. The practical effect of this is that bulks of grain consisting of a *mixture* of varieties are not as valuable to the maltster as those consisting of a single variety. Not only is this so, but it has been shown that *pure* seed of any variety produces more grain per acre than mixed seed and thus on two scores it is important for the grower to sow seed of a single pure variety. Commercial stocks of such seed are already available, and they will naturally increase in quantity in proportion to the demand.

In some parts of the country, and more severely in some years than others, barley suffers from attacks of smut, a

disease so familiar to barley growers that it does not require detailed description here.

The presence of smut in a crop means a direct loss of grain varying with the intensity of the attack, but as the spores spread to unaffected grain during thrashing, an additional monetary loss is entailed, as a result of the depreciation in colour and general appearance of the bulk of the grain.

Various means of controlling smut have been suggested, and formalin solution, 1 pint of formalin to 30 gallons of water, sprayed or sprinkled on the grain just before sowing, is one of the most easily prepared and at the same time one of the most effective fungicides.\* Although this is an effective control, it is impossible in practice to secure immunity, and the grower is well advised to make it a practice to draw his seed requirements from smut-free crops.

**Varieties for Sowing.**—Within recent years considerable attention has been directed to the question: Which are the best varieties for malting and at the same time the most remunerative to the grower? Fortunately, it has been found possible to combine high yield, good malting quality and strong straw, and it now only remains for growers to ascertain the suitability of several recently introduced varieties bearing these characteristics for the special conditions of soil and climate with which they have to deal.

*Spring-sown Varieties.*—Varieties of spring-sown barleys are divided into two classes, broad and narrow-eared, according to the shape of the ear.

As a rule broad-eared types are best suited to good loams and heavier classes of soil, and the narrow-eared to lighter soils. The broad-eared varieties succeed well in the northern districts as they are earlier ripening than the most valuable of the narrow-eared types.

For a time broad-eared varieties suffered from “necking,” or loss by ears dropping off the straw on ripening or as a result of heavy winds, but several new forms have been bred and introduced into commerce in which this defect has been remedied (see below).

#### ARCHER.

#### *Narrow-eared Varieties.*

- |                         |   |
|-------------------------|---|
| <i>Grain</i>            | - Not very large, colour rather grey, finely wrinkled skin.   |
| <i>Straw</i>            | - Short and wiry, ear very seldom detached from the straw either by wind or in handling during harvest.                         |
| <i>Soil and Climate</i> | Suits a wide range of soils but is perhaps best on light and medium loams; on heavier soils is inclined to be late in ripening. |
| <i>Remarks</i>          | A prolific variety, generally producing good malting samples; on poor soils it succeeds better than any other type.             |

\* Leaflet No. 328 (*Smut in Oats and Barley*).



## SPRATT-ARCHER.

- Grain* - Slightly larger and brighter coloured than Archer; finely wrinkled skin.
- Straw* - Similar to Archer, but somewhat stiffer; leaves finer.
- Soil and Climate* In regard to soil, generally similar to Archer, but will probably succeed on richer soils better than that variety.
- Remarks* A hybrid variety obtained by crossing Archer and Spratt; more prolific and of higher malting quality than Archer and earlier ripening.

## GOLDTHORPE.

*Broad-eared Varieties.*

- Grain* - Large and bright coloured.
- Straw* - Long and generally erect, but becomes brittle on ripening and the ears are then liable to break off.
- Soil and Climate* Suited to heavy loams and later districts.
- Remarks* One of the best broad-eared varieties in regard to both yield and malting quality. Earlier ripening than Archer and slightly earlier than Spratt-Archer.

## PLUMAGE-ARCHER.

- Grain* - Large, good colour, and finely wrinkled skin.
- Straw* - Erect and not so long as Goldthorpe, and the ears are not liable to fall off the straw when ripe.
- Soil and Climate* Suited to good and heavy loams, and, as it is earlier ripening, to later districts.
- Remarks* A hybrid variety, raised by crossing Plumage, a broad-eared barley, and Archer. In yield and quality occupies a leading position amongst present-day varieties.

## ARCHER-GOLDTHORPE.

- Grain* - Large, good colour, and very finely wrinkled skin.
- Straw* - Short, erect and stiff, and ears are not liable to break off the straw when ripe.
- Soil and Climate* Suited to good and heavy loams, and, as it is distinctly early ripening, to late districts.
- Remarks* A hybrid variety obtained by crossing Archer and Goldthorpe. In yield not equal to Spratt-Archer, but in quality it equals or possibly exceeds that variety. Should succeed well on heavy soils in late districts.

## MALTSTER.

- Grain* - Large, good colour.
- Straw* - Fairly long and erect.
- Soil and Climate* Suited to good and heavy loams and to late districts.
- Remarks* A hybrid variety obtained by crossing four varieties. Except on a few soils it is not equal in yield to narrow-eared forms or to some of the more recently introduced broad-eared forms. Malting quality good.

## SPRATT

- Grain* - Large and coarse.
- Straw* - Fairly long, erect and stiff.
- Soil and Climate* Especially well suited to soils with large quantities of peaty matter in their composition.
- Remarks* Almost entirely a feeding barley on soils such as those mentioned; this variety produces very heavy crops but the quality of the grain is poor and is usually only fit for feeding.

1917.

- Grain* - Large and good colour.  
*Straw* - Fairly long, strong and stiff. Ear erect and free from "necking" or breaking off the straw.  
*Soil and Climate* Suits a wide range of soils.  
*Remarks* A prolific form, with undoubtedly good standing straw. Quality varies considerably with the soil on which the crop is grown; somewhat inclined to coarseness.

*Autumn-sown Varieties.*—In some districts it is the custom to sow barley in the autumn, and for this purpose varieties of six-rowed types are commonly used, mainly on account of their winter hardiness.

Varieties of this class are distinguished from those sown in the spring by the character of the ear in which there are six rows of fully developed grains instead of the usual two. Two well-marked divisions of winter varieties exist, one similar to the broad-eared varieties in the two-rowed classes in so far as the grains are set closely together on the stalk of the ear, and the other similar to narrow-eared varieties in the greater distance between the grains on the ear stalk.

Both divisions are usually known by their botanical names, *Hordeum hexastichum* and *Hordeum vulgare*, but the latter has in addition the much commoner names, "bere" or "bigg."

*Dense ears (analogous to broad-eared varieties).*

#### HORDEUM HEXASTICHUM.

- Grain* - Fairly large.  
*Straw* - Short, stiff and wiry with a tendency to become brittle when fully ripe.  
*Soil* - Is probably best suited to good heavy loams.  
*Remarks* A good winter-hardy variety which produces heavy crops of grain of from medium to very fair quality.

*Lax ears (analogous to narrow-eared varieties).*

#### HORDEUM VULGARE (Bere or bigg).

- Grain* - Fair size but somewhat uneven in shape owing to the twist in the four lateral rows of the ear.  
*Straw* - Medium length, wiry.  
*Soil* - Suited to a varied range of soils provided they are well drained.  
*Remarks* A good winter barley variety producing heavy crops of grain of from medium to very fair quality.

The grain of both classes of winter barley is liable to be thin and not, as a rule, of particularly good malting quality, but on suitable soils heavy crops are produced which, if not up to malting standard, can be utilised with advantage for stock feeding.



Winter barley resembles the varieties usually sown in spring in its inability to exist in badly-drained soils, and, as it has naturally to live through the wettest months of the year, this essential condition of well-drained soil must not be overlooked.

\* \* \* \* \*

## LIVE STOCK IMPROVEMENT IN ENGLAND AND WALES IN 1922-23.

THE Ministry's Live Stock Scheme has now been in operation for nine years, and the progress made during a period of exceptional difficulties indicates that its objects and methods are being increasingly appreciated by the farming community. The Scheme aims at grading up the inferior stock of the country by the introduction of more systematic and careful methods of breeding; this end is being achieved by educating farmers to the use of sound pedigree sires and to the keeping of records of the milk yields of their cows, and financial assistance is provided to bring these methods within the reach of the smaller farmers. The progress of the Scheme on these lines may be gauged from the figures given in the tables in the present report for 1922-23 (1st April-31st March).

### BULL AND BOAR SCHEMES.

YEAR.	BULLS.			BOARS.		
	No. of		Total	No. of		Total
	Societies.	Individuals.	Animals.	Societies.	Individuals.	Animals.
			Bulls			Boars.
1914-15*	369	43	497	115	—	115
1915-16	489	28	633	180	—	193
1916-17	543	15	659	186	15	216
1917-18	578	14	710	172	92	264
1918-19	604	7	721	156	167	350
1919-20	568	6	675	120	225	399
1920-21	561	6	668	135	285	441
1921-22	726	3	847	113	416	550
1922-23	831	1	947	93	451	569

\* Including the period 1st February, 1914—31st March, 1914.

**Bulls.**—It is very satisfactory to find that notwithstanding the agricultural depression there has again been a marked increase in the number of premium bulls located under the Scheme during the year ended 31st March, 1923; 947 bulls were located as compared with 847 during the previous year, and of

these no fewer than 553 were Shorthorns, followed by 94 Lincoln Red Shorthorns. As a result of the drop in the value of stock there was a general decrease in the average prices paid for all breeds, the general average price falling from £72 10s. 5d. in 1921-22 to £62 11s. 9d. The highest price paid for a bull provided under the Scheme was £273 for a Hereford bull, while 57 cost £100 or over. There was a marked increase in the number of service fees of 5s., and the numbers of the higher fees were on the whole well maintained. The number of bulls serving at the popular fee of 5s. was 430, while 274 served at higher, and 212 at lower fees. Premium bulls and their progeny have again scored many successes at Shows. As an instance it may be mentioned that a Shorthorn bull provided by one of the Bull Societies has during the 1922 Show Season won 8 champion cups, 2 reserves for cup, 13 first prizes, 8 second prizes and 2 third prizes.

Results of the continued use of good sires are now becoming apparent in districts where the Scheme has been in operation for some time. For example, a large dealer in Yorkshire recently expressed the opinion that the improvement effected by the Scheme had raised the value of the cattle bred in his district by fully £3 per head.

#### NUMBER AND AVERAGE PRICES OF BULLS.

Breed.		1914-15.			1921-22.			1922-23.					
		No.	Price.			No.	Price.			No.	Price.		
			£	s.	d.		£	s.	d.		£	s.	d.
British Friesian	...	1	37	0	0	7	78	18	7	6	77	15	8
Devon	... ..	16	41	0	0	70	64	9	2	90	59	10	3
Guernsey	... ..	—	—			6	54	4	2	7	53	9	3
Hereford	... ..	63	33	0	0	78	68	15	2	84	58	3	4
Linc. Red	... ..	33	32	0	0	89	73	1	8	94	63	14	11
Shorthorn	... ..	337	38	0	0	492	76	5	10	553	64	16	3
Red Poll	... ..	—	—			1	78	15	0	1	78	15	0
South Devon	... ..	6	37	0	0	20	69	5	2	17	58	11	6
Welsh Black	... ..	35	29	0	0	60	57	2	7	64	52	2	11
Other Breeds	... ..	6	28	0	0	—	—			—	—		
All Breeds	...	497	36	0	0	823	72	10	5	916*	62	11	9

\* 947 bulls were located, but grants in respect of 31 were in suspense at the end of the year.

#### Service Fees.

Year.	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	9/-	10/-	Over 10/-
1914-15	265	57	41	42	3	88	—	—	—	—	1	—	—	—	—	—
1921-22	46	38	26	74	7	346	1	48	3	6	160	6	4	2	51	6
1922-23	50	40	28	84	10	430	3	53	2	10	141	7	8	2	45	6



**Boars.**—The progress made by the Boars' Scheme during the year ended 31st March, 1923, has been slight as compared with the marked progress reported for the preceding year, but new ground has been broken and there is evidence that the Scheme has led to marked development of the pig-breeding industry in certain districts. For instance, reporting on a boar located at Alvechurch, Birmingham, the Live Stock Officer stated that the location of a premium boar had been followed by the introduction of at least 15 other pedigree boars in the district. Of the 569 boars located 199 were of the Large White breed and 141 of the Large Black, followed by 77 of the Middle White breed. As in the case of bulls there was a general decrease in the average prices paid for the various breeds, the general average price being £15 0s. 4d. as compared with £18 3s. 0d. for the previous year. The highest figure for the year is represented by a Gloucestershire Old Spots which had an estimated value of £63. The service fees showed a relaxation of their upward tendency, but there was a substantial increase in the number of fees of 5s., 300 boars serving at this fee, 172 at higher, and 74 at lower fees.

Subsidised boars and their progeny have again been very successful at Shows, and the following typical instance may be of interest. At the fourth Annual Show held at Keresley on the 24th August, 1922, premium boars, sows served by premium boars, and the progeny of premium boars carried off five first prizes, four second, three third and one special prize, leaving for the other pigs one second, one third and one special prize only.

#### NUMBER AND AVERAGE PRICES OF BOARS.

Breed.	1914-15.		1921-22.		1922-23.	
	No.	Price.	No.	Price.	No.	Price.
		£ s. d.		£ s. d.		£ s. d.
Berkshire ... ..	10	8 0 0	11	23 19 10	11	18 2 3
Cumberland ... ..	—	—	32	17 11 10	30	16 5 0
Essex ... ..	—	—	7	33 11 5	4	23 7 6
Glos. Old Spots ... ..	7	7 0 0	51	21 4 4	37	21 8 0
Lincoln Curly Coat ... ..	4	8 0 0	24	13 0 4	31	12 3 10
Large Black ... ..	18	7 0 0	157	17 3 6	141	14 12 7
Large White ... ..	64	7 0 0	167	17 5 1	199	13 13 10
Large White Ulster ... ..	—	—	—	—	2	16 0 0
Middle White ... ..	12	7 0 0	62	19 4 3	77	15 11 7
Tamworth ... ..	—	—	1	17 0 0	1	20 0 0
Wessex Saddleback ... ..	—	—	11	22 16 11	13	16 2 3
All Breeds ... ..	115	7 0 0	523	18 3 0	546*	15 0 4

\* 569 boars were located but grants in respect of 23 were in suspense at end of year.

*Service Fees.*

Year.	2/-	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	10/-	Over 10/-
1914-15	21	62	10	5	6	—	2	—	—	—	—	—	—	—	—	—
1921-22	1	10	13	13	36	6	245	1	42	5	7	111	3	3	22	10
1922-23	—	7	12	13	37	5	300	—	51	4	2	99	—	4	13	1

**Sheep.**—The Scheme for the improvement of Welsh Mountain Sheep, to which financial assistance was first given by the Ministry in 1919-20, is growing in popularity. During the year under review grants at the rate of 3s. 4d. per ewe served, up to a maximum of £10, were made to 14 societies in respect of 17 approved pedigree rams; 1,041 selected ewes were served, being an average of 61 per ram. In accordance with the Regulations the ram, ewes and progeny are required to be ear-marked. The average hiring fee of the rams was £9 15s. 4d., and the average service fee was 1s. 2d. The rams hired were of the best quality, including prize-winners at the Welsh National and County Shows, and the Scheme is greatly appreciated in the districts for which it is provided.

**Milk Recording.**—During the recording year 1st October, 1921, to 1st October, 1922, the Milk Recording Section of the Scheme has continued to make steady progress, three societies and 19,000 cows having been added. The Scheme is now operating in practically every county in England and Wales. The following table shows the progress made as regards the number of societies, members and cows since the inauguration of the Scheme in 1914:—

**MILK RECORDING.**

	Year.*	Societies.	Members.	Herds.	Cows.
1st April to 31st March	1914-15	16	264	306	7,331
	1915-16	20	350	398	9,811
	1916-17	22	441	495	12,950
	1917-18	25	503	555	14,404
1st October to 30th September	1917-18	27	639	708	19,793
	1918-19	38	1,191	1,332	37,880
	1919-20	46	2,075	2,312	61,323
	1920-21	52	3,328	3,664	97,903
	1921-22	55	3,949	4,362	117,023

\* Prior to 1st October, 1917, there was no uniform year for Societies.

It will be observed that the tendency is for societies to grow in size rather than in number. This is due to the fact that the majority of the societies have now extended the scope of their operations so as to cover the whole of their respective counties. In other cases where there are several small contiguous societies endeavour is being made to amalgamate them



so as to form strong county societies. There are 14 societies with a membership of over 100, 19 with a membership between 50 and 100 and 22 with less than 50 members. A table showing certain particulars of all the societies is given in the table on p. 618.

*Increase in Average Yields.*—The annual returns furnished by the 55 societies for the recording year under review show that of the 117,023 cows and heifers recorded, 54.1 per cent. were cows which had been retained in the herds for the full year, and the average yield for these full-year cows was 6,670.81 lb.—an appreciable advance on the average for the previous year when the full-year cows, which represented 49 per cent. of the cows and heifers recorded, gave an average of 6,562.95 lb. The averages shown in the following statement indicate that the yields of milk-recorded herds are steadily increasing year by year:—

*Comparison of Average Annual Yield for Societies for the Last Four Milk-Recording Years.*

Year 1st Oct. to 1st Oct.	No. of Societies.	Particulars of all Cows and Heifers recorded:			Particulars of Cows recorded for full year.		
		No. of Cows and Heifers.	Total Yield (gal.).	Average Yield (gal.).	No. of Cows.	Total Yield (gal.).	Average Yield (gal.).
1918-19	38	37,880	16,204,941	450	17,989	10,543,516	579
1919-20	46	61,323	29,344,887	479	27,266	17,363,347	637
1920-21	52	97,903	48,512,380	495	48,248	30,892,620	640
1921-22	55	117,023	60,463,617	517	63,318	41,208,073	65

The following figures, taken from the records of the Oxfordshire Society, show how the average yield per cow is being raised in certain herds, and are typical of what is occurring in many herds. The figures show the average yield per cow during the first year of recording as compared with the average yield during the year ended 1st October, 1922.

Herd.			Average Yield per Cow during Year.				
			<i>Year.</i>	<i>lb.</i>		<i>Year.</i>	<i>lb.</i>
A	...	...	1916-17	5,204	...	1921-22	6,588
B	...	...	1915-16	7,464	...	"	9,507
C	...	...	1918-19	6,320	...	"	8,730
D	...	...	"	6,600	...	"	7,831
E	...	...	1919-20	5,545	...	"	8,128
F	...	...	"	6,267	...	"	8,070

As a further instance it may be mentioned that in Montgomeryshire a smallholder with 25 acres of poor land, by

careful selection, had six cows averaging 1,048 gallons, and that he attributed his success mainly to selection and to advice given on rations.

*Issue of Certificates.*—The number of milk record certificates issued to members was 2,432. This number represents 2.08 per cent. of the *total* number of cows recorded, and 3.84 per cent. of the number of cows which were recorded for the full year. Of the 2,432 certificates issued only 228 were for yields of less than 6,000 lb., while 627 certificates, *i.e.*, over a quarter of the whole number, were for yields of 8,000-9,000 lb.

The sixth volume of the Ministry's Annual Register of Dairy Cattle was issued in July last. It contains particulars of 1,499 cows (belonging to 305 members) in respect of which certificates have been issued by the Ministry, showing that they have yielded 8,000 lb. or over of milk during the milk recording year ended 1st October, 1922, or an average of 6,500 lb. for that year and one or more preceding consecutive years. Fourteen recognised breeds or types are represented in the sixth volume, and there are in addition 93 cross-bred cows (*i.e.*, cows which do not conform to one recognised breed or type) whose milk yields have justified their inclusion under the standard required. Of the 1,499 cows entered in the sixth volume 1,271 gave over 8,000 lb. of milk during the year, and 228 were entered on an average of 6,500 lb. or over. Of the 1,271 cows which were entered on the one year's yield 554 gave between 8,000 and 9,000 lb.; 332 between 9,000 and 10,000 lb.; 181 between 10,000 and 11,000 lb.; 99 between 11,000 and 12,000 lb.; 44 between 12,000 and 13,000 lb.; 26 between 13,000 and 14,000 lb.; 11 between 14,000 and 15,000 lb.; 6 between 15,000 and 16,000 lb.; 4 between 16,000 and 17,000 lb.; 5 between 17,000 and 18,000 lb.; 4 between 18,000 and 19,000 lb.; 3 between 19,000 and 20,000 lb.; 1 between 23,000 and 24,000 lb.; and 1 over 24,000 (*viz.*, 24,465½ lb.).

This issue of the Register contains the first list of cows in respect of which certificates of merit have been issued, certifying that such cows have yielded not less than 24,000 lb. of milk over a period of three consecutive years and have calved at least three times during that period. Another interesting feature of the volume is the addition of a Bull Section, which is intended to be of use to farmers who desire to obtain the services of bulls of proved milking strain. Bulls are eligible for this section if their dams and sires' dams have been entered in the Register, or if they have two or more daughters so entered. It is hoped



that as the Register becomes more widely known and its object more generally understood, farmers will avail themselves of the useful information which it contains.

*Calf Marking.*—The Ministry's calf-marking scheme, the adoption of which is optional, has now been taken up by all but one of the societies. The number of animals marked under this Scheme during the year was 11,517, as compared with 7,831 during the preceding year.

*Cost of Milk Recording.*—As regards the financial side of milk recording it is satisfactory to find that the cost of recording no longer shows the marked tendency to increase which has been noticed in previous years, and it may reasonably be expected that as the societies expand and become more efficiently organised a reduction in cost will result.

*Commercial Value of Milk Recording.*—The commercial value of milk recording continues to be demonstrated by the prices realised at sales for recorded non-pedigree cattle and their progeny, and the following are particulars of some of the sales which have been reported to the Ministry.

At a sale on the 29th November, 1922, at Twyford, non-pedigree Dairy Shorthorns realised an average price of 49 guineas for 46 cows and heifers, the highest prices being 71, 70, 65, 64 and 62 (three times) guineas. The Live Stock Officer stated that "Recording increased the value at least £15 per cow," and the Press opinion was that "the sale was one of the most successful of its kind this year."

At the Lancashire Milk Recording Society's fifth Autumn Show and Sale on the 7th November, 1922, 70 non-pedigree cows and heifers, mainly Dairy Shorthorns, realised an average price of 45 guineas, the highest prices being 100, 81, and 80 (twice) guineas.

At the autumn show and sale promoted by the Cumberland and Westmorland Milk Record Sales Association at Penrith, on the 9th November, 1922, 30 non-pedigree Dairy Shorthorn cows and heifers averaged 47 guineas, the highest prices being 115, 100 and 75 guineas.

At a sale on the 2nd October, 1922, of the herd of a member of the Berkshire Milk Recording Society, 59 non-pedigree Shorthorn and British Friesian cows realised an average price of 47 guineas, the highest prices being 92, 90, 74 (twice), 72 (twice), and 70 guineas. The Live Stock Officer reported that the general opinion was that recording had increased the value at least £15 to £20 per head.

APPENDIX A.—STATEMENT giving particulars of 55 Milk Recording Societies operating during the year ended 1st October, 1922.  
(The Societies are arranged in order of total number of animals recorded.)

NAME OF SOCIETY.	Number of Members.	Number of Herds.	Total No. of animals recorded.	No. of cows recorded for full year.	Av. yield of cows recorded for full year, lb.
Essex County ... ..	188	213	7,467	4,095	7,166
East Sussex ... ..	185	217	6,317	3,302	6,841
Berkshire ... ..	114	134	5,161	2,756	6,580
Hampshire ... ..	126	145	4,704	2,366	6,668
North West Wilts. ... ..	95	107	4,636	2,931	6,438
Dorset ... ..	68	99	4,468	2,466	5,796
Kent ... ..	146	167	4,361	2,059	6,966
Hertfordshire ... ..	139	151	4,303	2,195	6,896
Surrey ... ..	155	164	4,052	2,035	6,646
Yeovil ... ..	109	129	4,000	2,436	6,424
Salisbury and District (Wilts.) ... ..	59	86	3,941	2,463	7,108
Norfolk ... ..	139	160	3,840	2,347	6,810
Lancashire County ... ..	135	142	3,513	1,570	6,703
Oxfordshire ... ..	95	113	3,350	1,765	6,390
West Sussex ... ..	90	100	3,085	1,822	6,925
Warwickshire ... ..	121	130	3,043	1,480	6,733
Suffolk ... ..	105	118	2,430	1,545	6,790
South Devon ... ..	95	103	2,423	1,094	5,956
Leicester ... ..	80	83	2,176	1,114	6,953
Northants ... ..	79	90	2,120	1,103	6,312
Shropshire ... ..	71	79	2,084	1,411	6,772
Cambridge and District ... ..	79	86	2,083	1,120	7,248
Cheshire County ... ..	57	63	2,017	1,043	6,639
Cumberland and N. Westmorland ... ..	142	142	2,005	970	5,971
Yorkshire ... ..	113	121	1,992	918	7,420
Staffordshire ... ..	74	77	1,954	1,111	6,986
Nottinghamshire and District ... ..	52	57	1,676	715	6,810
Derby and District ... ..	42	45	1,509	677	7,049
Bristol and Bath ... ..	78	79	1,503	805	6,664
Buckinghamshire ... ..	53	59	1,407	707	7,235
Denbighshire and Flintshire ... ..	72	73	1,392	846	6,644
Worcestershire ... ..	58	60	1,389	652	6,556
Cadbury (Somerset) ... ..	46	56	1,232	696	6,336
Warminster and Mere (Wilts.) ... ..	26	29	1,227	823	6,434
Tees Valley (Durham) ... ..	36	44	1,120	517	7,242
Peak (Derby) ... ..	36	36	949	294	6,829
Frome and District (Somerset) ... ..	23	23	924	697	6,211
East Devon ... ..	51	53	899	458	6,054
Kendal and S. Westmorland ... ..	40	41	828	463	6,011
Bedfordshire ... ..	31	32	744	363	6,991
Campden, Moreton and District (Glos.) ... ..	34	36	740	467	6,328
North Somerset ... ..	27	31	696	452	6,538
Anglesey and Carnarvonshire ... ..	52	53	653	394	5,561
United Counties ... ..	40	41	652	382	6,480
Lincolnshire ... ..	30	32	645	372	6,346
Cornwall ... ..	42	43	630	329	5,612
Allendale (Northumberland) ... ..	35	36	601	344	6,775
Shepton Mallet and District (Somerset) ... ..	15	17	596	439	6,017
Monmouthshire ... ..	28	30	588	198	6,257
Cheltenham and District (Glos.) ... ..	23	25	534	370	7,564
Melton Mowbray and District (Leic.) ... ..	24	24	527	287	6,063
Hertfordshire ... ..	24	24	487	296	6,763
Quedgeley and District (Glos.) ... ..	30	31	484	287	6,862
Montgomeryshire ... ..	27	27	478	243	5,865
Highbridge and District (Somerset) ... ..	15	16	388	228	6,467
TOTALS ... ..	3,949	4,362	117,023	63,318	6,670



At Amberley Court, Monmouth, on the 5th September, 1922, the herd of a member of the Monmouthshire Milk Recording Society was sold by auction. The herd consisted of 26 pedigree Shorthorn cows and heifers, 8 pedigree Shorthorn calves, 12 non-pedigree Shorthorn cows and heifers, and 2 non-pedigree Shorthorn calves. The highest prices for the pedigree cows were 110 guineas (twice), 100 guineas and 92 guineas, and for the pedigree calves 32 and 30 guineas. For the non-pedigree cows the highest prices were 160, 100 and 95 guineas and for the non-pedigree calves 26 guineas. The average price for the 12 non-pedigree cows was 67 guineas as against 57 guineas for the 26 pedigree cows—good evidence of the value of milk recording.

At the spring sale of Dairy Shorthorns at Penrith on the 11th May, 1922, a non-pedigree recorded cow, the property of a member of the Cumberland and North Westmorland Milk Recording Society, realised £108.

The following are the principal memoranda used in connection with the live stock operations of the Ministry, and copies of them can be obtained free of charge on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Leaflet 282...	...	Scheme for Improvement of Live Stock.
Leaflet 146...	...	The Value of Records of the Milk Yields of Cows.
No. 609/T.L. (L.2)		Bull Grant Regulations.
No. 392/T.L. (L.4)		Milk Recording Regulations.
No. 446/T.L. (L.11)		Boar Grant Regulations.

\*            \*            \*            \*            \*            \*

## LIGHT HORSE BREEDING IN 1922-23.

The operation of the Light Horse Breeding Scheme during the season 1922 (1st April-31st March) followed the usual lines except that for reasons of economy the number of Ministry's Premiums was limited to 15, and only 57 instead of the usual 85 King's Premiums were awarded at the Thoroughbred Show in 1922 owing to the lack of stallions of sufficient merit to justify the full number of awards.

**Premiums awarded for 1922 Season.**—The following Premiums were awarded for the season 1922:—12 Super Premiums, 45 King's Premiums, and 15 Ministry's Premiums (all thoroughbred horses except 3 Ministry's Premiums, which were awarded to 1 Hunter Stallion and 2 Cleveland Bay Stallions), 5 Riding Ponies, 18 Welsh Cobs, 3 Welsh Roadsters, 4 Dales Ponies, 5 Fell Ponies, 10 New Forest Ponies, and 43 to Mountain Pony Stallions in Wales.

**Service Season, 1922.**—The numbers of mares served by the various classes of stallions were as follows:—

	<i>No. of Mares Served.</i>	<i>Average per Stallion.</i>
12 Super Premiums ...	855	71
45 King's Premiums ...	3,034	67
15 Ministry's Premiums...	872	58
5 Riding Pony Premiums ...	205	41

**Foaling Results from Service Season 1921.**—The foaling percentage of stallions is calculated upon Returns furnished to the Ministry by the mare owners, and the results from the 1921 Service Season were as follows:—

	<i>No. of Mares served in 1921.</i>	<i>No. of Returns furnished to Ministry.</i>	<i>Average Percentage.</i>
12 Super Premiums...	941	883	51
48 King's Premiums ...	3,407	3,154	54
26 Ministry's Premiums ...	1,398	1,228	54
5 Riding Pony Premiums...	263	243	60

The highest percentage (71) was obtained by two stallions "Ednam" and "Cock-a-Hoop," owned respectively by Messrs. T. and H. Ward and Lt.-Col. Sir Merrick R. Burrell, Bart., C.B.E.

**Thoroughbred Show, 1923.**—The Annual Show of Thoroughbred Stallions for the purpose of awarding Premiums to stallions for the service season 1923 was held at the Royal Agricultural Hall on 27th and 28th February and 1st March, and the Judges were Messrs. Ernest Bellaney and Romer Williams. The number of entries was 87, one less than in 1922. A satisfactory feature of the Show was the entry of 24 new stallions, of which 9 were considered to be of sufficient merit to receive an award. One of these, "St. David," the property of H.M. the King, took third place among the Super Premium winners. The full number (60) of Premiums (including 12 Super Premiums) was awarded, and the King's Cup was won for the fourth year in succession by "Gay Lally" belonging to the Compton Stud, the Reserve horse being "Scarlet Rambler" as in the previous three years.

**Horse Breeding Act, 1918.**—During the licensing year 1st November, 1921, to 31st October, 1922, there was a marked decrease in the number of stallions licensed under this Act, the number being 3,479 as compared with 3,816 in the preceding year. There was, it is satisfactory to note, a proportionately greater decrease in the number of stallions for which licences were refused. There were 165 refusals, 16 of which were



after appeal, the numbers for the previous year being 244 and 18 respectively.

Of the 3,479 licensed stallions, 3,129 were pedigree animals and the remaining 350 were horses that were not entered or accepted for entry in any recognised Stud Book.

The following tables show the number of stallions of each breed concerned that were licensed or rejected, and the number refused licences in respect of the various prescribed diseases or defects:—

#### NUMBER OF STALLIONS LICENSED OR REFUSED.

	<i>Heavy.</i>	<i>Pedigree.</i>		<i>Non-Pedigree.*</i>	
		<i>Licensed.</i>	<i>Refused.</i>	<i>Licensed.</i>	<i>Refused.</i>
Shire ... ..		2,052	106	122	8
Clydesdale ... ..		237	16	7	1
Suffolk ... ..		216	8	2	1
Percheron ... ..		47	—	2	—
Others ... ..		—	—	80	5
<i>Light.</i>					
Hackney ... ..		213	5	41	2
Thoroughbred ... ..		150	7	4	—
Arab ... ..		17	1	3	—
Hunter ... ..		4	—	3	—
Cleveland Bay ... ..		9	—	—	—
Yorkshire Coach ... ..		2	—	—	—
Welsh Roadster ... ..		5	—	1	—
American Trotter ... ..		1	—	4	—
Others ... ..		—	—	18	—
Ponies (including Welsh Cobs)...		176	3	63	2
<i>Totals</i> ... ..		3,129	146	350	19

\* Non-pedigree stallions are arranged as far as possible under types.

#### NUMBER OF STALLIONS REJECTED UNDER THE PRESCRIBED DISEASES AND DEFECTS.

Roaring ... ..	37	Defective Genital Organs ... ..	6
Whistling ... ..	39	Springhalt ... ..	11
Sidebone ... ..	29	Shivering ... ..	8
Cataract ... ..	15	General Unsuitability ... ..	1
Ringbone ... ..	16		
Bone Spavin ... ..	3	<i>Total</i> ... ..	165

Twenty-eight appeals were made against refusals of licences, and in 12 cases these were successful.

Notwithstanding the decrease in the number of stallions licensed the Ministry has information which suggests that the number of unsound stallions which formerly travelled at very low fees, and which constituted the most serious hindrance to grading up of horse breeding, have been practically eliminated from the road. Since the Horse Breeding Act came into force

the Ministry's Inspectors and Live Stock Officers and the Police have endeavoured to secure observance of the Act by stopping stallions on the road and requiring the production of the licences, and in cases where the Regulations have been infringed proceedings have been taken by the Police. The fact that there was a marked decline in the number of prosecutions is evidence of a more general knowledge of and compliance with the Act on the part of stallion owners.

**National Stud.**—The operations of the National Stud during the year ended 31st December, 1922, continued to be satisfactory, under the able direction of Capt. Greer. The profit for the year amounted to approximately £3,000, bringing the accumulated Trading Profit up to £33,550 since the establishment of the Stud in 1916. It is very satisfactory to record that the National Stud headed the list of Winning Breeders for the year 1922 with 25 horses winning 42 races of a total value of £32,939.

During the year 1922, 15 yearlings were sold at an aggregate gross sum of £17,951, *i.e.*, an average of £1,197, which, in view of the general fall in prices, may be considered satisfactory.

Both of the stallions at the Stud, "Silvern" and "White Eagle," had full subscription lists, and the performances of the stock of the mares at the Stud, which number 37, during the racing season of 1922 testify to the excellence of the brood mares.

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## GRADE "A" MILK.

A. T. LORAM.

IN the July number of this *Journal* appeared an illustrated article on this subject, and the writer of the article asked and answered the question, Is Grade "A" Milk worth while? The present writer would like to add his emphatic "Yes" to that answer, and readers may be interested in the methods of another licensed producer of Grade "A" (Tuberculin Tested) Milk.

No season of recent years has had hotter spells than the summer now past. It has afforded an opportunity for proving that given *clean milk* there is no difficulty in keeping it sweet 36 hours and longer on the hottest thundery day. The conditions are :—

1. *Clean Cows*, groomed free of all dirt on flanks and udders. Teats and surrounding parts should be wiped clean with a wet cloth immediately before milking.





FIG. 1.—Cowshed for 30 Cows, with Bull Pen and Calf Stalls.

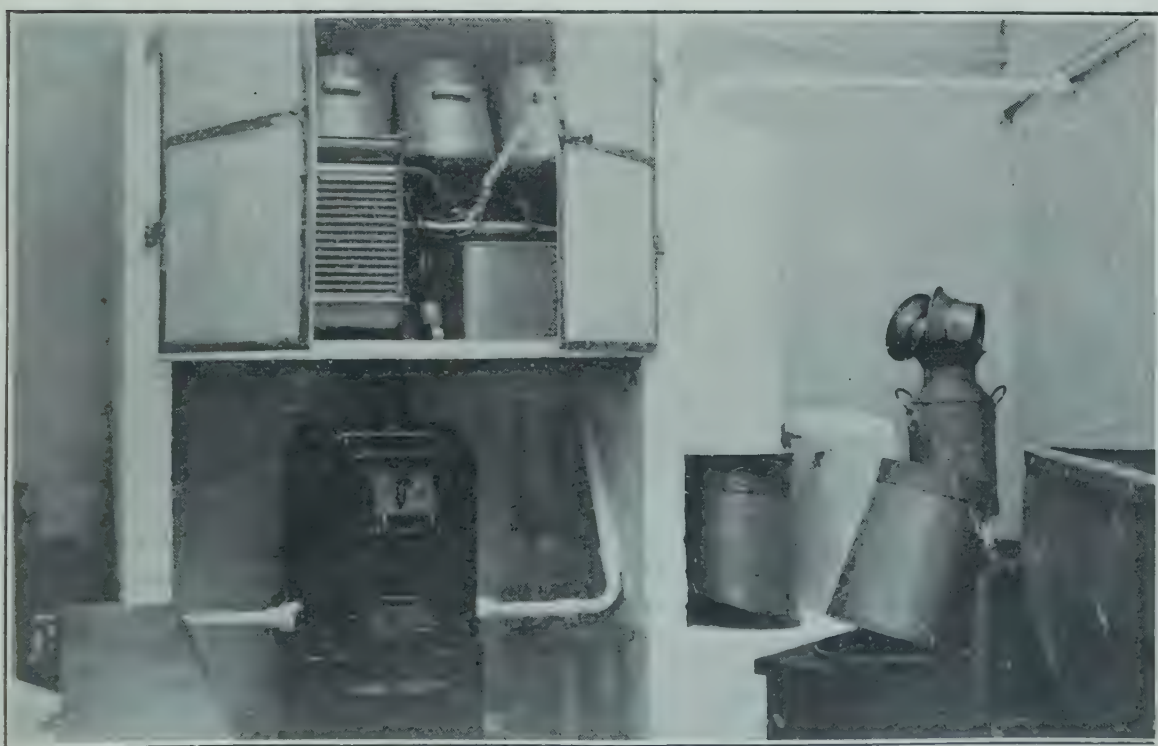


FIG. 2.—Sterilizing Room adjoining Milking Shed.



FIG. 3.—Showing the arrangement of the Milk Room.



2. *Clean Milkers* clothed in washable caps and overalls, using domed pails, clean stools, and washing their hands with soap and water between milking each cow.

3. *Clean Vessels* which have been sterilized by steam heat and kept in a dust-free chamber till needed.

4. *Milk Removed from Cow House* as quickly as possible, passed over a cooler and bottled immediately; or, if sent to a depot for bottling, covered in an airtight churn.

In these four conditions lie nine-tenths of all that is involved in high-grade milk production. Expensive cowhouses and fittings are not essential. At the same time good results are more easily obtained if the milking shed has an impervious washable floor and limewashed walls and ceiling.

**The Cowshed.**—The writer's cowshed is here shown (Fig. 1) The beds measure 5 ft. from the edge of the crib to the edge of the gutter; the width between divisions is 4 ft. 3 in.; the width of the gutter is 18 in., with a fall towards the path. Inside of these measurements big Devon cows find room and comfort, tied with the free-moving yokes shown in the picture. At the same time practically all droppings fall into the gutter free from the bed.

**Sterilizing Room.**—Adjoining the milking shed is the sterilizing room (Fig. 2). It contains a trough for washing milk vessels, and is used for nothing else. There is also a steaming block on which cans can be inverted, so that a steam jet reaches every crevice. A cupboard is arranged over the heating apparatus so that buckets, milk cooler, strainers, etc., can be thoroughly dried after steaming. The cupboard is frequently limewashed and is fly and dust proof. Doors are made of asbestos cement sheets on light iron frames. A 40-gallon cylinder provides abundant hot water which can be raised to steam at short notice with small consumption of fuel by an ordinary greenhouse stove. The one fire successfully meets all requirements.

**Milk Room.**—An inexpensive milk room is conveniently situated outside the cowshed, and yet not too far for the milkers to go. Fig. 3 shows the arrangement of it.

A dial and weighing bucket is suspended from the ceiling. At the top is an 8-gallon receiving tank with bead rim. Over this is stretched a sheet of thick straining material secured by a band of solid rubber (perambulator tyre) which is nipped into place with a lever such as is used for putting on motor tyres. A wide shallow stretch of strainer makes a better filter than a narrow deep one. From this tank milk falls slowly over the

cooler and thence into the churn beneath. A concrete platform 18 in. high makes convenient the lifting of buckets to the strainer. No dust-making operations or dung moving is allowed anywhere near while milking and cooling are being done. No dirt of any kind is allowed to accumulate near the milking shed. A cart stands in the yard to receive all sweepings, and this is removed to the fields daily. This and the use of a little chloride of lime now and then has reduced the fly population to a minimum.

As a result of care in details such as these, the writer has been able to get some very low bacterial counts when samples of milk are sent to Reading College.

**Public Opinion.**—Readers, however, will ask: Does the British Public think Grade “A” Milk worth while? To this a qualified answer must be given. Thinking people in increasing numbers appreciate the efforts of the Ministries of Health and of Agriculture to ensure the provision of clean milk, but it must be admitted that there is not a bewildering demand for it yet. The need of a Clean Milk Crusade is urgent, if for no other reason than because between leaving the cow and its consumption by humanity it is often sadly injured. A rousing demand for Clean Milk by the people of England, and a willingness to pay the little extra cost entailed in its handling, would be an encouragement to the farmer and a boon to the nation.

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## PIG-KEEPING.

### II.

W. A. STEWART, M.A., B.Sc. (Agr.),  
*Northamptonshire Farm Institute.*

*Principles of Feeding; Constituents of Feeding Stuffs;  
The Albuminoid Ratio Method of Compounding Rations;  
Notes on Feeding Stuffs; Milk; Dry Feeding.*

A KNOWLEDGE of the composition of feeding stuffs, together with some understanding of the functions in the animal body of the different food constituents, and of the needs of the animal when being fed for different purposes, is the only sound and economical foundation on which one can build up a system of feeding.

**Principles of Feeding.**—In addition to water, which is present in greater or less proportion in all feeding stuffs, chemical



research has shown that there are in foods certain other constituents or groups of constituents which are commonly described as follows:—(1) proteins or albuminoids, (2) fats and oils, (3) carbohydrates (starch, sugar, etc.), (4) mineral matter or ash. It had been assumed that these four groups alone represented everything essential for growth, development and the production of meat and milk, but this belief has had to be modified. Albuminoids supply the constructive material for the making of muscle or lean flesh and for the repair of tissues. In milk-producing animals, the albuminoids in the food supply the raw material for the albuminoids in the milk. If albuminoids are fed in excess of the animal's requirements, the excess may be utilised for supplying heat and making fat.

The fats or oils and carbohydrates are used for making fat and for the supply of body heat and energy. For this purpose it has been computed that 1 lb. of fat is as valuable as 2 to  $2\frac{1}{3}$  lb. of albuminoids or carbohydrates. A moderate quantity of oil in the ration aids digestion.

*Mineral Matter.*—It has been usual to regard the mineral matter as of value only for bone formation, but experiments conducted at the Rowett Research Institute by Orr and Crichton\* have shown that this idea is mistaken. Ten or twelve minerals are now known to be necessary to keep the animal in health. They are present as essential constituents in the blood and soft tissues where they play an important part in the chemical and physical processes which take place, and they are necessary for the normal functioning of every organ in the animal's body.

The influence of mineral matter in feeding has not received as much attention as it would appear to merit. Experiments conducted in America have illustrated in a general way the importance of minerals, but there is an absence of exact and definite information on the matter. Certain practical conclusions, however, can be drawn with regard to lime† from the Rowett Institute's experiments. It was found that for proper growth and development a pig requires a supply of lime. The quantity required varies with the age and in proportion to the rate of growth, but  $\frac{1}{3}$  oz. per day of lime (CaO) may be taken as the average requirement of a three months old pig. The effects of insufficient lime are a slowing down in the rate of growth, a softening of the bones, and in extreme cases death.

The cereal grains are poor in lime, but comparatively high

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\* *The Pig Breeders' Annual*, 1922.

† *Scottish Journal of Agriculture*, July, 1922, and *The Pig Breeders' Annual*, 1922.

in phosphates. Lucerne, clover and good grazing will supply a fair amount of lime. Fish meal and milk residues are rich in lime, phosphates, and the other essential minerals. It is quite possible, therefore, that a pig confined in a sty and fed on a mixture of cereal grains, may not receive sufficient mineral matter, and in that case, if milk is not available, some fish meal could be used to correct the deficiency.

McGowan and Crichton\* have described a disease in young pigs, which occurred in a breeding herd where the sows were kept out in the open till within a fortnight of farrowing and then brought into sties with concrete floors, and fed on a mixture consisting of maize, brewers' grains and fish meal. The young pigs did badly and many deaths occurred. Certain characteristic symptoms were present both throughout the course of the disease and on post-mortem examination of cases. The investigators suggest that while the sows were at grass they were obtaining sufficient iron but after being brought indoors to farrow, owing to the conditions and the nature of the food the supply of iron ceased. The characteristic symptoms of the disease were attributed to iron deficiency, and large doses of ferric oxide were given to the sows in their food with good results both as a preventive and as a cure for the disease. It would appear possible that iron deficiency may be a commoner cause of malnutrition in pigs than is generally recognised.

*Vitamins.*—We now come to the reason for the modification of the older assumption that albuminoids, fats and oils, carbohydrates, and mineral matter supplied all that was needed to maintain the animal body in health. Experimental evidence has shown that something more than those four constituents is required. In 1912, Hopkins published the results of his experiments with rats. He showed that on a ration of pure protein, sugar, lard and salts, young rats ceased to grow and ultimately died, but the addition of a very small amount of milk made a tremendous difference to their health and rate of growth. Other investigations have proved that there are certain substances which must be present in the diet of both human beings and animals, otherwise malnutrition and diseases occur. These substances have been called "vitamins" or "accessory food factors." We have at present no exact knowledge as to their form or composition as they have not yet been isolated in the laboratory, and belief in their existence rests entirely on the results of experiments, which have shown that on diets of

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\* Leaflet of the Rowett Research Institute, Bucksburn, Aberdeen.



purified food stuffs, certain diseases and symptoms occur, which either do not occur or disappear when certain substances are added to the ration. These substances are assumed to contain vitamins. From the results of further investigations, notably those conducted by Professors Drummond and Plimmer, it has been shown that there are at least three different vitamins which have been called A, B and C.

Absence of *Fat Soluble A* or Anti-Rachitic Vitamin results in cessation of growth and a susceptibility to infectious disease. There is some doubt as to whether rickets may be due to a deficiency of this vitamin. It is present in whole milk and in animal fats, particularly cod liver oil, and in green leaves. Cereals are low in this vitamin and such of it as may be contained in cereals is mainly confined to the germ and to the outer covering of the grain. Vegetable oils are low in it. Animals do not require much of Vitamin A to maintain health and they have the power of storing up a reserve supply. It is not readily destroyed by heat although prolonged exposure to high temperature will destroy it.

*Water Soluble B* or the Anti-Neuritic Vitamin is so named because of the symptoms of nervous disorder which occur when it is absent. The results of the deficiency of this vitamin were first seen in human beings in the East. Natives who live on polished rice suffer from the disease called beri-beri. Whole rice does not induce the disease and the reason would appear to be that Vitamin B is present in the outer covering of the rice grain and when the rice is polished, the vitamin is removed. In animals a deficiency of Vitamin B results in cessation of growth, in degeneration of the reproductive organs and symptoms of paralysis. Certain forms of lameness in pigs may be due to the same cause. Vitamin B is present in milk, eggs and seeds, particularly in the embryos of seeds, in leguminous plants such as clover and lucerne, and in dried yeast, cabbages, and potatoes. It is not affected by drying and not very readily destroyed by heat, though its potency would appear to be affected when it is subjected to high temperatures.

When *Vitamin C* is deficient, scurvy develops, hence this vitamin is called Anti-Scorbutic or Anti-Scurvy. In animals scurvy has certain characteristic symptoms—the appetite fails, the joints become swollen and tender and the animal is reluctant to move. This vitamin is present in milk, green leaves, particularly cabbage leaves, swedes, potatoes and most vegetables. Grains contain very little, but seedlings are rich in it. Vitamin C is readily destroyed by heat and also by drying.

Very little is known about how vitamins produce their good effects, and although experiments on smaller animals such as rats and guinea pigs have certainly shown that vitamin deficiency may have very harmful results, a word of caution is necessary, otherwise undue stress may be laid on it. Vitamins have formed a popular matter of interest, and a great deal has been written about them, with the result that their practical importance to the pig feeder may have become very considerably exaggerated. One should bear in mind the wide distribution of vitamins and the fact that comparatively small quantities are necessary for the maintenance of health. It is conceivable, however, that under certain conditions the pig may suffer from lack of vitamins. The pig grows more quickly than other farm animals and vitamins are particularly necessary for rapid growth. When the pig is confined to a sty and its diet is made up largely of cereal grains and commercial by-products without the addition of green stuff, roots and milk, there may be an insufficient supply of vitamins.

Fattening pigs do not suffer so readily as breeding animals. When breeding stock are kept in confinement for long periods, symptoms of malnutrition occur, which are probably due to vitamin deficiency, but under the open air system on grass or arable land crops, pigs are likely to find all the vitamins they require. At the Rowett Institute pigs on a ration containing only small but apparently sufficient quantities of vitamins showed as great gains per day and per pound of food consumed as those to which large quantities of vitamins were given. This result is in accordance with our experience on the experimental farm at the Moulton Farm Institute.

In the light of present day knowledge about vitamins, it is prudent to feed on a mixed diet, to include home grown feeding stuffs and green food, particularly leguminous crops, like clover and lucerne, or roots such as swedes, and potatoes. As is generally known, milk is a most valuable food, and this is partly due to its containing vitamins. It should not be necessary to purchase expensive animal oil or dried yeast preparations, for inclusion in the ration, with a view to supplying vitamins. The natural sources are much more satisfactory. Crude cod liver oil is sometimes recommended, but our experience has been that when even small doses were used, and its use discontinued altogether three weeks before killing, the carcass was tainted with the smell and flavour of the oil.

**Suitable Digestibility and Bulk in the Pig's Ration.**—In addition to the fact that the ration should be properly



balanced in the matter of albuminoids, oil and carbohydrates, and should contain mineral matter and vitamins, it must be suitable with regard to digestibility and bulk. When the food appears in the dung in much the same state as when eaten, it has passed through the pig without being digested and without benefit to the animal. The pig has a simple digestive system, and it is therefore important that the ration should be comparatively easily digested. There should not be a large proportion of coarse fibrous material. Succulent green food is readily consumed by pigs, but as far as our data on the subject goes, it would appear that pigs digest only about 40 per cent. of the green food which they consume, as against 80 to 90 per cent. of barley meal and other suitable concentrated pig foods. In spite of this, it is sound and economical practice to feed green food provided that its cost is reasonably low. It is very doubtful, however, whether it is ever economical to allow pigs to depend entirely on green food as their sole diet. It is usually found better to supplement the green stuff with a small allowance of concentrated food.

The practical issue as between the outdoor and indoor systems of pig-keeping is not merely a matter of return in live weight increase for food consumed, it is a much wider question of farming economics, necessitating a broad view. It has been repeatedly demonstrated, however, that the open air system allows of more pigs being maintained conveniently on a commercial basis and ensures a healthier and more prolific breeding stock.

**Nutritive Ratio.**—It has been demonstrated by experiments and proved in practice that the most economical way to feed live stock is by compounding a ration so that it contains a certain quantity of digestible albuminoids in proportion to the digestible oil and carbohydrates. The proportion necessary varies according to the age and stage of growth of the animal; according also as to whether the animal is pregnant or barren; and according to whether it is giving milk or being fattened for slaughter. This proportion is called the albuminoid ratio of the food. When the albuminoid ratio of a food is suitable for the pig's requirements, 1 lb. of live weight increase should be secured from every 3 to  $3\frac{1}{2}$  lb. of meal consumed, but if the albuminoid ratio is not correct, then 6 lb. of meal may be required to produce 1 lb. of live weight increase. The albuminoid ratio of any food is obtained by multiplying the amount of digestible fat by 2.3 (because 1 lb. of fat is approximately

as effective as 2·3 lb. of carbohydrate), adding this to the percentage of digestible carbohydrates and dividing by the percentage of digestible albuminoids. Taking the average analysis of barley meal as follows:—

<i>Digestible Albuminoids.</i> per cent.	<i>Digestible Oil.</i> per cent.	<i>Digestible Carbohydrate.</i> per cent.
7	1.5	64
	$1.5 \times 2.3$	= 3.45
		67.45
		$67.45 \div 7 = 9.6$

The albuminoid ratio of barley meal = 1 : 9.6

The following is a classification\* of concentrated foods used in pig feeding, with their Albuminoid Ratio:—

GROUP I.—*Foods Rich in Albuminoids, containing 30 per cent. or over.*

Albuminoid Ratio.				Albuminoid Ratio.			
Fish Meal	...	...	1 : $\frac{1}{5}$	Decorticated Earth Nut Cake	...	...	1 : 1
Dried Yeast	...	...	1 : $\frac{1}{2}$	Linseed Cake	...	...	1 : 2

GROUP II.—*Foods moderately Rich in Albuminoids, 17-30 per cent.*

Albuminoid Ratio.				Albuminoid Ratio.			
Beans and Peas	...	...	1 : $2\frac{1}{2}$	†Dried Grains	...	...	1 : $3\frac{3}{4}$
Maize Gluten Feed	...	...	1 : $3\frac{1}{4}$	Coconut Cake	...	...	1 : 4
†Palm Kernel Cake	...	...	1 : $3\frac{1}{2}$				

GROUP III.—*Foods Poor in Albuminoids (under 17 per cent.) and Rich in Carbohydrates (over 50 per cent.).*

Albuminoid Ratio.				Albuminoid Ratio.			
†Bran	...	...	1 : $4\frac{3}{4}$	Wheat	...	...	1 : $7\frac{1}{2}$
Pollards	...	...	1 : 5	Barley	...	...	1 : $9\frac{1}{2}$
Maize Germ Meal	...	...	1 : 7	†Rice Meal	...	...	1 : 10
†Oats	...	...	1 : 7	Maize	...	...	1 : 11

\*Based on the classification in "Feeding of Dairy Cows," by J. Mackintosh.

†Foods fairly high in fibre and of only moderately good digestibility.

**Feeding Standards for Different Classes of Pigs.**—The approximate ratios found to be suitable for pigs are as follows:—

Albuminoid Ratio.				Albuminoid Ratio.			
Little Pigs, 3-6 weeks old	...	...	1 : 4 to 5	In-pig gilts and sows	...	...	1 : 6
Young Pigs, 6-12 weeks old	...	...	1 : 5 to 6	Sows in milk	...	...	1 : 5
Fattening Pigs	...	...	1 : 6 to 8	Stock Boars	...	...	1 : 5

It is not suggested that these figures are mathematically exact, but at the present stage of our knowledge of feeding they form the most useful and simple scientific check on rations which we have. For the past two years we have made up our rations for the commercial herd of pigs on the Experimental Farm on this basis, and after trying other methods of checking, such as estimating the digestible protein and starch equivalent and the total number of food units, we have abandoned those in favour of the simple albuminoid ratio check. Close observation of the results has shown the latter method to be sufficiently accurate for practical purposes. It will be clear that in making up a ration, one would look to Group I or Group II to find the



requisite albuminoids. The foods at the top of Group III, *e.g.*, pollards, are well balanced. Pollards have long been known as a safe food for young or breeding stock, whereas those at the bottom of Group III are essentially fattening foods.

**Notes on Feeding Stuffs. Group I.—Fish Meal.**—It has been found that fish meal has a special value in feeding pigs. This may be due to the nature of its protein and its high content of mineral matter. Pigs apparently require some protein of animal origin and this can be supplied in the form of fish meal, meat meal or dried blood. The two latter are somewhat dangerous on account of the risk of disease. It is generally believed that 10 per cent. of fish meal will supply all the mineral matter required by the pig. In order that the carcass may not be tainted with the smell and flavour of fish, it is most important that a good brand should be used and that the quantity should not exceed 10 per cent. of the ration. A good brand of fish meal should not contain more than 4 per cent. of oil or 3 per cent. of salt and should be guaranteed as made from sound white fish only. An additional safeguard against tainting can be secured by discontinuing its use during the last fortnight or three weeks of fattening.

*Dried Yeast.*—In addition to being rich in albuminoids, dried yeast contains the Vitamin B. In use it has the rather serious drawback that it sets up fermentation when mixed with anything of a sugary nature.

*Decorticated Earth Nut Cake* should only be used in small quantity and for adult pigs, as it is apt to cause scouring.

*Linseed Cake.*—At the rate of about 10 per cent. in the ration, linseed cake is a most valuable food for maintaining health and producing “bloom” of coat and skin. If very rich in oil and fed in fairly high quantities to sows in milk it is liable to cause the little pigs to scour. Used in excess of 10 per cent. to fattening pigs it may produce a soft yellowish fat.

**Group II.**—*Beans and Peas* are the two home-grown foods richest in albuminoids. Both have a somewhat binding effect and should not exceed a quarter of the ration.

*Maize Gluten Feed* is a by-product from maize. It is a good pig food without any apparent bad effect on the pork or bacon.

*Palm Kernel Cake* is now fairly extensively used. It is usually cheap but it is not a high class feeding stuff and is rather unpalatable and not very highly digestible. It should not be fed to young pigs, and should never exceed 20 per cent. of the ration. Palm kernel meal (extracted) is an inferior food.

*Dried Grains* in small quantity not exceeding 10 per cent. help to stimulate milk production in sows. As a food, however, they are rather fibrous and of low digestibility.

*Coconut Cake* is fairly similar to palm kernel cake. It will soak up very large quantities of water. It is quite a useful feeding stuff if not used in too high proportion in the ration.

*Bran* contains a good deal of fibre and on that account should be limited to 10 per cent. of the ration. It has a mild medicinal action and when fed wet acts as a laxative. It is good for sows just before and after farrowing as it prevents constipation and stimulates milk production.

*Pollards* are too well known to require comment. They form the safest pig food that we have.

*Maize Germ Meal* should consist of the germ of the maize grain. It has a high oil content and is therefore slightly laxative. If used in excess the oil may have a harmful effect on the carcass.

*Oats* contain so much husk that they are not specially suitable for pig feeding. If the husk can be got rid of, the oat meal forms a wholesome feeding stuff.

*Wheat* is best used in small proportion mixed with other feeding stuffs. If used too liberally it makes the ration pasty and sticky, causing indigestion.

*Barley* is the staple fattening food. It is highly digestible.

*Rice Meal* is high in oil and fibre. If used in quantity it produces rather an inferior type of carcass. It is low in mineral matter and this possibly explains the common belief that rice meal causes lameness.

*Maize* is very starchy and forms a fattening food. If used in excess it produces a type of carcass which is strongly objected to by bacon curers. The lean of such a carcass is not of good quality and the fat is soft and oily.

*Milk*.—Whole milk is a nearly perfect food and is almost entirely digestible. Separated milk, which is more commonly used in pig feeding, is invaluable for young pigs and sows in milk. As most of the fat has been removed it has a slightly binding tendency. Some of the Fat Soluble A vitamin has been removed but the other vitamins are still present along with the mineral matter. One gallon of separated milk is roughly equivalent to 1 lb. of digestible mixed meal.

*Whey* is milk from which the greater part of the fat and proteins have been removed. 1½ gallons of whey would be roughly equivalent to 1 gallon of separated milk or 1 lb. of digestible mixed meal.



**Dry Feeding.**—Dry Feeding has been under trial and investigation on the Northamptonshire Experimental Farm, Moulton, since July, 1922, and the results obtained here and elsewhere would appear to indicate that dry feeding is likely to play an important part in the economics of pig-keeping in the future. The established system of feeding wet food, in a more or less liquid condition, entails much labour where pigs are kept on a commercial scale. Unless the pig attendant is thoroughly skilled and highly intelligent, the quantity of water in the food is not varied as it should be according to the pig's requirements, especially as affected by weather and atmospheric temperature, with the result that in cold weather pigs are frequently forced to consume more water than they either need or want, while in warmer weather they may not receive enough. With dry feeding and the provision of a constant water supply in the pen or run, this most important matter is controlled by the pig itself. The pig drinks just what it requires, and this is a most vital point in feeding both in the matter of health and development.

Digestive troubles and colds, which frequently occur in winter and develop readily into pneumonia or other lung affections, can often be traced to giving too much water under the wet feeding method, and the chill to the system which this entails. Our experience and observations confirm the opinion that such disorders are less common with dry feeding. With an efficient type of feeder, the food is always quite sweet, and for young pigs in particular this is a very important detail. Sour food is one of the commonest causes of illness. Pigs when dry fed, masticate their food. Mastication is the first process in efficient digestion. Efficient digestion and absorption should mean that less food is required to produce 1 lb. of live weight increase.

The practice of dry feeding goes best with the open-air system of pig-keeping. It can, however, be practised in yards or pens, but it is important that dry fed pigs should have adequate facilities for exercise.

It has generally been found advisable to allow an unlimited ration to fattening pigs, and to young pigs up to the age of about 16 weeks. When this is done the feeder can be filled up to its capacity and the pigs allowed to help themselves. It is therefore unnecessary to provide feeding accommodation so that all the pigs concerned can feed at one time. A feeder which will accommodate say 12 pigs at a time will be sufficient for a bunch of three or four times this number, and even the smallest and most weakly pigs will have ample opportunity of feeding.

as all the pigs will not want to feed at once. For breeding stock the limited ration is the most satisfactory method. When limited to a few pounds a day, it is necessary to put the whole ration in the feeder once daily, or to halve it—putting half in in the morning and half in the afternoon. When limited rations are used, sufficient feeding space for all the pigs to feed at one time will be required. Even where the food is given in two portions daily there is saving of labour compared with the wet method of feeding.

In-pig sows up to three weeks before farrowing have done extremely well on 2 to 3 lb. of dry meal per day in winter and less in summer, together with green stuff, roots or potatoes. When potatoes are fed in quantity it is necessary that the meal should be specially rich in albuminoids. On a modified open-air system, for stores and breeding stock, including sows up to shortly before farrowing, dry feeding is satisfactory and economical.

In the case of fattening pigs, there is considerable difference of opinion. Such experiments as have been carried out are hardly conclusive. It is essential that the pigs should not be allowed to become costive. To prevent this they must receive either green food or roots, or the ration itself must be sufficiently laxative. This has been secured here by the inclusion of a small percentage of crushed linseed or linseed cake.

In practice, when preparing pigs to be sold as medium pork (100-120 lb. dead weight) and for bacon (140-170 lb. dead weight), it has been found satisfactory to run the pigs on arable land crops on dry food, and then to have them in yards at the farm buildings for the last three or four weeks before disposing of them, and to feed them on wet food. It is a convenient time to discontinue the use of fish meal when the pigs are put on the wet food. This ensures that there is no possibility of the carcass being tainted.

*Dry Feeders.*—A dry feeder should have the following qualifications:—(1) It should protect the food from wind and rain and from birds and vermin; (2) it should be possible to regulate the supply of food so that it will run slowly from the hopper and not accumulate in the trough; (3) it should be easily movable; (4) it should be as simple as possible in construction; (5) it should be durable and not easily broken or damaged, moved or upset by pigs. After extensive trials with the principal makes, we have not yet found a perfect dry feeder.



## THE CULTIVATION OF SUGAR BEET.

ALFRED WOOD, F.C.A.,

*Secretary of the British Sugar Beet Growers Society and  
Secretary and Assistant Secretary, respectively, of the  
Kelham and Cantley Beet Sugar Factories.*

**Nature of the Crop.**—The sugar beet is a root plant of the same family as the mangold. Properly cultivated it is a long tapering root, of a shape and colour similar to a parsnip, but larger and broader at the top (Fig. 1). Its weight, excluding the crown and leaves, averages from  $1\frac{1}{2}$  to 2 lb. If through shallow cultivation it develops fangy roots it loses in sugar content. It has a heavy green foliage. Unlike the mangold it grows almost entirely below the surface. The beet develops innumerable rootlets and root hairs, absorbing water and plant-food to feed the plant, which permeate and ventilate a wide radius of soil (Fig. 2). These are detached in the act of lifting the beet.

**Sugar Content.**—Formerly the sugar beetroot (or white mangold) only contained 6 per cent. of sugar, but after selection of seed over many years the plant now produces and stores in the root from 15 to 20 per cent. of its net weight of sugar. All commercial seed used in sugar beet cultivation for the production of sugar is grown from "mother seed," which is carefully propagated from year to year at seed producing stations under the control of scientists trained in this special branch of the work. If seed were grown the second year from the commercial sugar beet the plant would be inclined to "throw back," and the beets grown therefrom would be of no value for sugar production. The sucrose or sugar in the beet is the product of air, light and water. It is produced in the leaves and stored in the root. When the leaves have done their work they become greenish yellow and wilt. The top or crown of the root (from below the lowest leaf or bud) is removed on the field (Fig. 1) as it contains the smallest percentage of sugar and the greatest amount of impurity. It is therefore useless for sugar extraction, and is in fact harmful to the manufacturing processes.

**Climate.**—It has been proved that the climate of England is eminently suitable for the crop. This was amply shown in the bulk cultivation of beet which took place during the exceptionally sunny but dry season of 1921, and the correspondingly wet and sunless season of 1922. In both these years the sugar

content in the beet averaged over 16 per cent. The Eastern Counties of England most resemble the chief beet-growing districts of the Continent, but satisfactory crops of beet have been grown in most parts of this country south of the Humber, and there is no reason to suppose that the crop might not be successfully grown still farther north.

**Soil.**—The best soils are deep loams, well supplied with lime and organic matter. Any free-working soil, however, adapted for growing roots, barley or potatoes should grow beets well. Even with strong clays the beet can be made to thrive with liberal treatment of the soil, the main objection being the

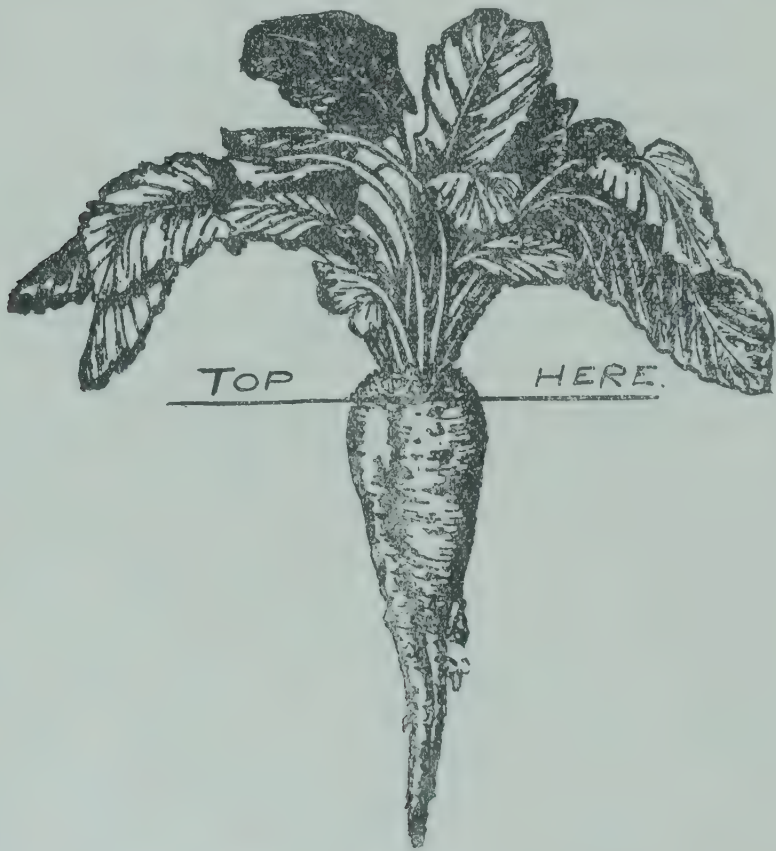


FIG. 1.—A typical Sugar Beet, showing correct Method of Topping.†

increased labour in lifting a deep root, although a high sugar content is usually obtained. Very shallow soils should not be used. Instead of a long tapering root, the beet takes a mangold shape and develops fangy roots. Deformed roots are also caused by insufficiently drained soil.

**Rotation.**—Sugar beet can be grown several years in succession on the same land, but this is not recommended. Each year the crop becomes lighter and is more liable to attack by pests, especially if the tops and leaves have been ploughed in. It is more economical to grow the beet crop as the



cleaning crop in the rotation, replacing mangolds, swedes or common turnips, to be followed by wheat, oats or barley and seeds. It is sometimes taken after a root crop, after a clover ley broken up early, or after peas or beans. There is no hard or fast rule for the place of sugar beet in the rotation. The farmer will decide, as with his other crops, according to the specific conditions of his own farm.

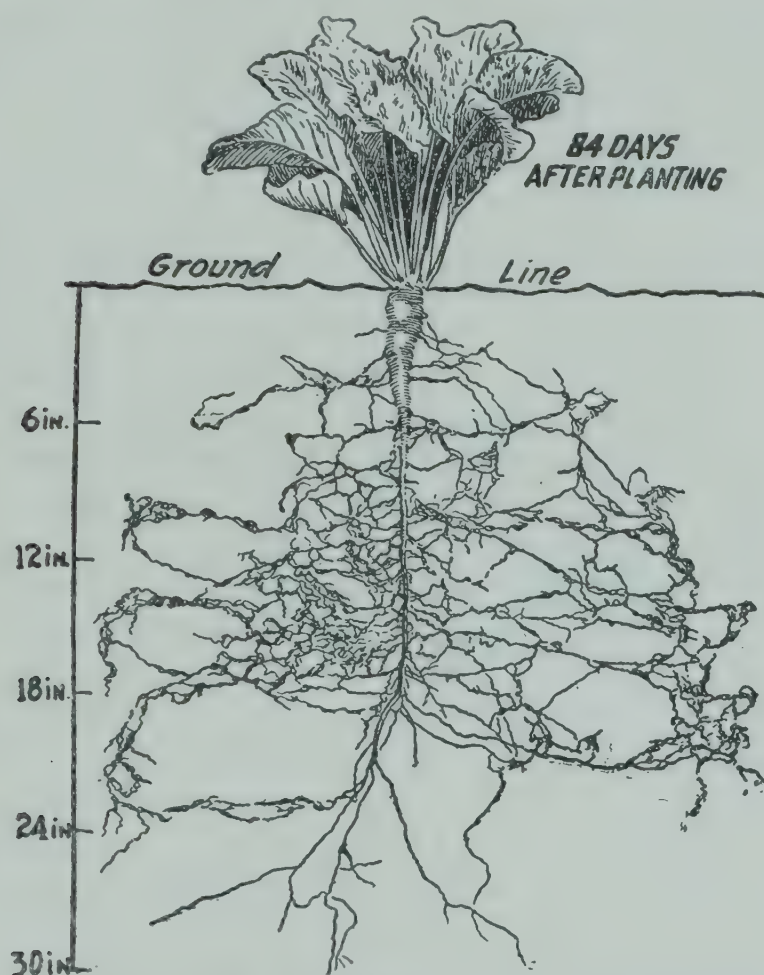


FIG. 2.—The Sugar Beet's Action on the Soil during growth.

**Cultivation.**—The cultivation of the beet crop is similar to that required for mangolds. *Deep working is essential* in the case of sugar beet. Preparation should take place as soon after harvest as possible. As soon as the cereal crop is clear of the field, weed and other seeds begin to grow, and their growth can be encouraged by light cultivation, not more than 3 in. deep, by skim plough or cultivator. After fourteen days to three weeks the land should be thoroughly cleaned of surface rubbish. Farmyard manure (10 to 12 tons per acre) is then carted on and ploughed in deeply to a depth of 10 in. or more and the land then left to be pulverised by the winter frosts. This would avoid spring ploughing, as a friable soil will be secured which

should be well worked in April in time for sowing. The roots must be given every opportunity of going deep. The under soil must therefore be thoroughly pulverised, while the upper soil should be more compact so as to give a downward direction to growth.

**Manuring.**—Practically all the manure in the rotation is applied to the sugar beet crop, *the succeeding crops requiring no manurial assistance*. The beet crop will not exhaust the soil and the manuring together with the thorough cultivation improves and cleans the land for the succeeding crops.

The sugar beet uses relatively large quantities of potash, but not so much nitrogen or phosphoric acid. Nitrogen stimulates the leaf growth. Potash is closely associated with the formation of sugar in the leaves. Phosphates are required less for the production of beets than for the formation of seed, which is not required in beet cultivation for sugar production. Beets which run to seed in the root year are starved in sugar content, and are useless for sugar manufacture. They should be taken out as they appear. They should never reach the factory as they are injurious to the working of good roots.

In general the manurial treatment required for a successful beet yield is that usually applied to secure a good potato crop. This will vary in different localities according to the nature and condition of the land, and the manuring of preceding crops. The experienced grower will manure his land according to his intimate knowledge of his own farm, making comparative tests to secure the best results, and no two growers will be found to act exactly alike in this respect. The following examples are therefore given with reserve, merely as an approximate guide to the new grower as to the relative values of the different manures on all soils, the quantities, in actual practice, being increased or reduced according to the condition of the land and the variations of the soil :—

		1. Heavy Soils	2. Medium Soils	3. Light Soils
Farmyard Manure	... ..	10 to 12 tons	10 to 12 tons	10 to 12 tons
Lime	... ..	1 cwt.	2 cwt.	2-3 cwt.
Phosphates (30 % to 35 %)	... ..	6 cwt.	4 cwt.	2 cwt.
Potassium Salts (20 %)	... ..	1 cwt.	3 cwt.	5 cwt.
Sulphate of Ammonia	... ..	1 cwt.	1 cwt.	1 cwt.
Nitrate of Soda	... ..	1½ cwt.	1½ cwt.	1½ cwt.

The farmyard manure and lime should be applied in the autumn, the phosphates (unless in the form of basic slag) and the potash in the spring. The sulphate of ammonia should be harrowed in when preparing the seed bed, and the nitrate of



soda should be used as a surface dressing in two parts, half after the first hoeing and the rest after the singling has been completed.

**Drilling.**—Seed is always supplied by the factory at cost price, and only beets grown from this seed are accepted. It is not possible to lay down a fixed date for drilling, as weather conditions vary from year to year. As the factories require some of the beet of each grower early in October, it is advisable for a grower to drill part of his acreage not later than the middle of April, but it is wise not to sow earlier. If sown earlier the early mild weather encourages growth, and if the later colder weather brings growth to a standstill for a time, the roots may then develop a tendency to run to seed. Early drilling will always enable a grower to re-drill if a satisfactory plant is not obtained at the first drilling. Where a large area is grown by a farmer, he should drill at three different times at intervals of 10 to 14 days. The beets will not then require singling or hoeing at the same time, and as they also do not ripen at the same time the average sugar content at delivery is kept higher because the factory requires deliveries for manufacturing in equal quantities during the season from 1st October to 20th December. *A good seed bed is essential.* A faulty seed bed is often the cause of patchy fields of plants. Drilling in a well-prepared seed bed gives the most successful results if the drilled rows are slightly pressed down by small rollers fixed behind the coulters. This has the advantage also of indicating the drilled rows, and a first hoeing can be done if found necessary even before the plants appear. The seed should be drilled on the flat in rows from 16 to 18 in. apart, preferably 16 in., and not more than 1 in. deep. Not less than 15 lb. of seed per acre should be drilled; abroad as much as 25 to 30 lb. are drilled. It pays to be generous with seed. This reduces the risk of poor germination and of plants being attacked by pests. It gives greater scope for securing a good “stand,” that is to say, the number of good plants per acre, and thus avoids a “thin” crop. If the plant is not coming up evenly the germination can usually be assisted by rolling, preferably across the rows. If the rolling is done early in the morning it helps to keep down pests.

**Hoeing.**—Success in sugar beet cultivation depends very largely on the singling (thinning) and hoeing of the sugar beet crop. The object is to cause all the efforts of growth to be concentrated upon the best plants which are being isolated to

create the sugar. Horse-hoeing should be done early, thoroughly and continuously until such time as it is no longer possible, owing to the rows being covered by the leaves of the plants. It should be commenced as soon as the plants in the row reveal themselves. Light draught horse hoes as used in America and Denmark are recommended. They are fitted with protecting disc coulter for the first early hoeing, replaceable by duck foot and angle tines as required. They are capable of hoeing four rows at a time, and the tines can be adjusted by the driver to allow for any irregularity in the rows. As the leaves are the sugar-producing agent care should be taken not to damage them. In hoeing, the roots, unlike mangolds, should be kept covered by soil. Uncovered roots lose sugar content. Hoeing must be maintained not only by the horse hoe between the rows, but by the hand hoe between the plants in the row. The beet crop compels the constant cleaning of the land from the moment drilling is started until the harvest begins. It necessitates special attention to the loosening of the soil between the plants. This allows light and air to penetrate the soil to the benefit of succeeding crops. Foreign experience has proved the value of this.

**Singling.**—When the plants show *four leaves* they should be carefully singled. Singling consists of two operations. First, bunches of plants in the row are isolated by chopping out with a hand hoe all intermediate plants between each bunch so that the bunches are 12 to 14 in. apart. The chopping-out should be at least 1½ in. deep to clear away any seed not yet germinated, and the block should not be more than 1 in. wide. On the black fen lands, where beets are inclined to grow big and coarse, a higher sugar content will probably be obtained if the plants are singled 8 in. apart. The actual singling takes place by loosening the soil in the bunch so that the plants fall apart, holding down the best plant it is intended to leave and removing all other plants and weeds in the bunch. Singling is usually paid for at piece-work rates. An experiment conducted in Germany showed the following results:—

<i>Time of Singling</i>						<i>Yield in Tons</i>
At the proper time	...	...	...	...	...	15 tons.
One week later	...	...	...	...	...	13.5 „
Two weeks later	...	...	...	...	...	10 „
Three weeks later	...	...	...	...	...	7 „

It is therefore clear that the yield per acre and the percentage of sugar content depend very largely upon early and proper singling.



**Moisture.**—A good root, that is to say, a long single root without fangs, produces the highest sugar content, because its storage qualities are the greatest. In addition, it more readily withstands drought, as it reaches down more deeply for moisture than the shorter or deformed roots.

**Pests.**—The sugar beet plant has been found to be less subject to attack by the mangold fly and other pests than the mangold plant.

**Harvesting.**—Ripeness is indicated by drooping of the leaves and their changing to a yellowish-green colour. About three-quarters of the foliage should have wilted, but the central leaves should still be fresh and green. Lifting is done by two operations. A beet lifter (Fig. 3) is used to loosen the beets from the soil surrounding them. They are then pulled out by hand, two at a time, knocked together to remove as much soil as possible, and laid in rows or thrown into heaps.

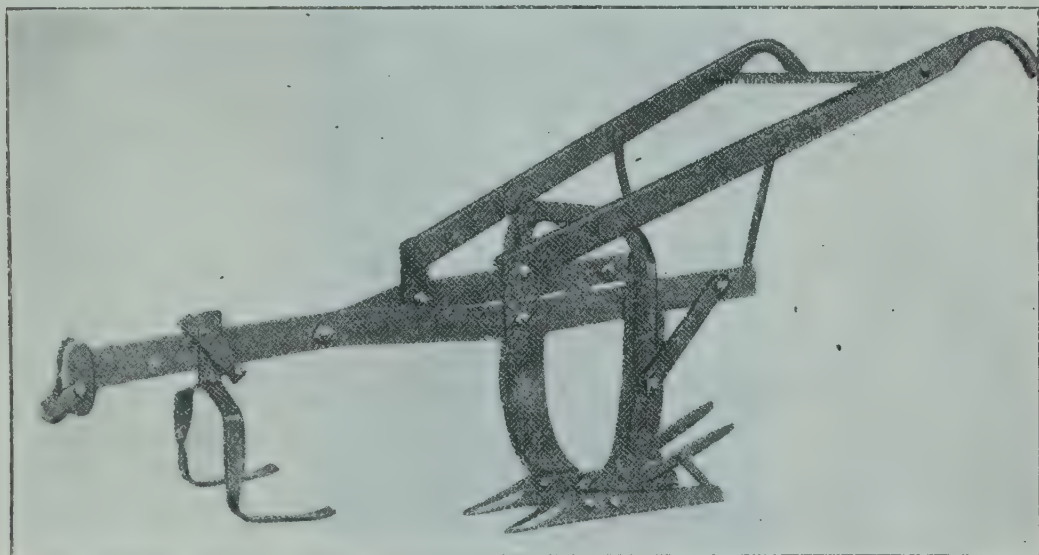


FIG. 3.—A Sugar Beet Lifter, adjustable for large or small beets.

Topping (Fig. 1) is best done by one blow of a heavy knife. Unless carting is done promptly the heaps should be covered with the tops and leaves to avoid reduction of sugar content through frost or the action of the sun. When there is danger of frost they should be clamped like mangolds. Beets do not suffer from the frost before lifting. They should be thrown into the carts with beet forks (Fig. 4) having prongs with small globular ends which do not pierce the beets.

**Tops and Leaves.**—The tops and leaves should be left on the field. They are equal in weight to 75 per cent. of the root when topped. If ploughed in they are of considerable manurial

value, but may assist in giving new life to parasites, animal and vegetable, which live on beets, if a beet crop follows on the same land. In foreign countries they are considered of greater value if used for feeding direct off the land for cattle, sheep or pigs. It is customary abroad in the autumn to take the tops and leaves to the fields where cattle are still grazing, as they cause a heavy milk flow. They are also ensiled to serve as a winter food. They should never be fed wet or dirty, and should be used carefully as they have a somewhat laxative effect.



FIG. 4.—A Fork for handling Beets.

**Yield.**—The yield varies according to the land on which the beets are grown as well as the care taken in preparing the land and in the after-cultivation. A fair average crop is 8 to 12 tons of washed and topped roots. Some districts, such as the Fen country, can produce crops up to 14 or 18 tons. The lighter crops often give a comparatively greater percentage of sugar content.

**Sugar Beet as a Cattle Food.**—The sugar beet is used mainly for conversion into sugar and is most profitably disposed of to



a factory, but it can also be used as a food for stock. *In cases where a trial crop is grown which cannot be sent to a beet sugar factory, the crop may be fed as follows:—*4 lb. of sugar beet (as topped) may be substituted for 8 lb. of mangolds or 1 lb. of cereal meals in a mixed ration. 20 to 30 lb. may be fed daily to dairy cows, as much as 50 lb. to fattening cattle, 10 lb. upwards to young cattle, and 10 lb. downwards to calves. For pigs, 1 lb. of barley can be replaced by from 4 lb. to 8 lb. of sugar beet in a mixed ration. The use of the whole sugar beetroot as a food for stock has no special value as compared with mangolds, though they are particularly suitable for pig feeding. On the other hand, the value of the tops and leaves and of the dried sugar beet pulp from the factory for this purpose cannot be over estimated.

**Delivery to the Factory.**—The price paid by the factory is a delivered price per ton of washed and topped beets and varies according to the sugar content in the root, as ascertained by the factory chemist. A calculation is made of the percentage of tare delivered by the grower in a fair sample which is washed and re-topped (if necessary). It is therefore to the grower's interest (a) to top correctly, and (b) to send the roots as free from dirt as possible, as he will be paying carriage upon weight for which he does not receive payment. The roots are washed at the factory and not by the grower. As the sugar content is ascertained from a sample of the roots in the form in which they enter the factory, and as the top contains a negligible amount of sugar, if the grower does not top properly, he will also reduce the proportion the sugar content bears to the weight of the whole root. This is important to him in its effect upon his price. If his yield is low through inattention to the points set out above, he will reduce his profit per acre, as he is paid according to the actual net tonnage delivered. He should also fully load the railway trucks, as the carriage rate for beet is fixed upon a minimum load of six tons. Otherwise he will again lose through excessive carriage charges.

**By-Products.**—The grower is always allowed, under the beet contract, to purchase back from the factory up to 5 per cent. of the net weight of beet delivered in dried beet pulp at the special price stated in the contract. This product is the main by-product of the factory and is a valuable food for stock, increasing the yield of fattening cattle and the milk flow of dairy cows. He is thus enabled to return to his land what the sugar beet crop has taken from it, and the dried pulp acts as

a substitute for the mangolds or swedes he would otherwise have grown for consumption on his own farm. This completes the agricultural circle, as it were, so that he has only taken from his land the sugar which has not drawn upon its fertility. On the contrary, the land has been made more productive for the crops following in the rotation. In foreign countries it has been proved that sugar beet increases the yield of the corn crops that follow by 10 to 15 per cent., and farmers are now beginning to testify to similar results in this country.

**The Growers' Return.**—In 1922 the factory offered 32s. per ton of washed and topped roots put on rail. In addition, 2s. was added or deducted proportionately for each 1 per cent. of sugar content above or below  $15\frac{1}{2}$  per cent. The average sugar content over the whole crop was slightly over  $16\frac{1}{2}$  per cent., so that the average return to the farmer was 34s. per ton on rail. Though costs of growing varied in different districts and according to the experience of the grower or his labour, it was acknowledged generally by the growers that their beet crop yielded a very satisfactory profit. For 1923 the price is 40s. per ton of beet delivered at the factory. There is again a variation in price if the sugar content is above or below  $15\frac{1}{2}$  per cent., 2s. 6d. being added or deducted proportionately for each 1 per cent. above or below that basis. There is, however, in 1923 a further variation according to the average sale price of sugar realised by the factory; 1s. per ton of beet is added or deducted proportionately for each 1s. or fraction thereof in the price of sugar above or below 40s. per cwt. The price of sugar at present is 54s. 6d. per cwt., so that if this be the realised price and the grower secures an average sugar content similar to that of last year, viz.,  $16\frac{1}{2}$  per cent., he would receive a return of 57s. per ton of washed and topped roots delivered at the factory. Allowing for a probable fall of 5s. per cwt. in the price of sugar, he would still receive 52s. as a delivered price, and as the average carriage, having regard to recent reductions in the rates, will probably be 5s. per ton, he would then receive 47s. per ton on rail for his beets instead of 34s. last year. Further reductions often accrue through delivering to the factory direct by cart or lorry, thus saving railway freight and one handling.

**Cost of Production.**—With regard to the cost of production, detailed costs are often misleading and can never be ascertained with accuracy for purposes of average, yet it is generally found that the total cost, whatever the variation in specific items



may be, approximates the same figure. From inquiries as to experience to date, the British Sugar Beet Growers' Society came to the conclusion that £15 might be considered as a fair average cost under present conditions of growing an acre of beet and putting the produce on rail. In some cases, however, the cost has not exceeded £12. It was also found that as the greater portion of the cost of a crop of beet consists of labour, considerable economies are possible as the grower becomes more experienced. Taking specific districts, however, such as the Spalding area, the cost per acre might reach £20, but the grower, as a rule, secured a much greater yield, which has more than compensated for this additional cost. The Society also found that the average yield under normal conditions might be taken at 10 tons per acre, although on account of certain special circumstances there was a lower average yield last year, and although in the previous year, in the areas serving the Kelham factory, the average yield was higher. An acre yielding 10 tons of beet might therefore be considered to cost not more than £15, and might cost not more than £12. This gives the cost per ton of beet at 24s. to 30s. per ton on rail, and with a greater yield a lower cost still. For this reason it is desired to emphasise the importance of the notes on hoeing and singling. Each ton of yield lost through unsatisfactory cultivation seriously reduces the growers' profit.

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## DATES OF BLOSSOMING OF APPLES AND PEARS.

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THE growing of apple trees in this country has occupied the attention of many people for hundreds of years, but few have been sufficiently interested to carry out annual observations and record systematically the behavior of the different varieties. Possibly trees are not favoured for observation work for the reason that results can be obtained but slowly and hold out little promise of completion in any one lifetime. The choice of such a plant would only be made by one possessed of great patience, and with little desire to push matters with great speed. All workers on pomology are aware of this and will appreciate the work which has been done by Mr. James

Udale, the experienced horticulturist of Worcestershire, whose observations on fruit trees have been made over a period of 20 years, and the work of Mr. Cecil H. Hooper, who has worked out statistics and averages to utilise Mr. Udale's records of the blossoming and fruiting of many varieties of apples, pears and plums. The chances afforded to Mr. Udale do not come to all. He established, in 1896, an experimental fruit plantation at Droitwich for the Worcestershire County Council, and was thus able to start his work early in the life of a new plantation and to continue to record the behaviour of these trees as they grew and came into bearing. The records commenced in 1896 and were completed in 1920. For the purpose of Tables I and II the figures for the first four years have been omitted.

Particular attention was given each year to the dates of flowering of different varieties and to the yield of each individual tree. The figures for yield can be of less use or importance for permanent records chiefly because of the varying factors in each locality which influence the crop. Some factors vary with every plantation and constitute a great uncertainty in the problem. Nevertheless the crop records are not without their interest and use, if their limitations are accepted and properly understood. The records of the date of blossoming are of more value, though even in this case there is a little uncertainty as to the influence of the stock on the date of flowering, and it is feared that information is lacking as to the type of stock used in the Droitwich gardens.

**Apples.**—There is a tendency for growers, at the present time, to limit the number of varieties of fruit to a few commercial kinds, which for trade reasons is both desirable and necessary, but as this may lead to the planting of large blocks of varieties the flowers of which are self-sterile, or are self-fertile to only a small degree, it becomes necessary for the planter to have accurate knowledge both as to the degree of self-fruitfulness and as to the period the variety is in blossom. With the self-sterile and partially self-sterile varieties such as Beauty of Bath, Cox's Orange Pippin and Grenadier, it becomes necessary to plant varieties which can serve as "mates" or pollenizers, and an important matter of this kind should not be left to chance. The pollenizer can only be of use if its pollen is ready when the flowers of the self-sterile variety are ready to receive it, and thus it is necessary to plant varieties with a common flowering period, or, at any rate,



varieties with flowering periods which overlap considerably. Mr. Udale found with apples that the longest period between the blossoming of the earliest and the latest varieties was 31 days, which is a very considerable range, but that the average range was about 16 days.

The records from Mr. Udale's observations are shown in Tables I and II, from which the order of flowering of the varieties can be seen. Based on these records and those obtained by observers in other parts of the country, the order of flowering is placed as follows:—\*

*Earliest* - Irish Peach (F1), Warner's King (F2), Bismarck (F3).

*Early* - - Beauty of Bath (S), Stirling Castle (F1).

*Mid-Season* James Grieve (F3), Gladstone (F3), Allington (F2), Rival (F2), Cox's Orange (S), Early Victoria (F1), Bramley (F3), Lord Grosvenor (F1), Ecklinville (F2), Worcester Pearmain (F3), Grenadier (S or F3).

*Late* - - Lord Derby (F1), Lane's Prince Albert (F3), Newton Wonder (F3), Annie Elizabeth (F3), Lady Sudeley (S or F3), Blenheim Orange (S).

*Very Late* - Royal Jubilee (S).

Mr. Udale's and Mr. Hooper's records will also be of use in assisting growers situated in exposed places or in places subject to late frosts, to select varieties which come into blossom at less dangerous periods. The varieties of apples that ripen first do not necessarily blossom first, for Mr. Udale found that the very late dessert apple, Sturmer Pippin, flowers early

TABLE I.  
Average Order of Blossoming and Yield of Apples at the  
Worcestershire Experiment Garden, Droitwich,  
1900 to 1920.

<i>Variety.</i>		<i>Yield in 21 years. lb.</i>	<i>Average yield per tree per year in lb.</i>
Bismarck	bush	1,340½	64
Stirling Castle	bush	1,481	70
Sturmer Pippin	bush (2 trees)	1,590½	38
Lord Grosvenor	bush (3 trees)	5,154½	82
Ecklinville Seedling	bush (3 trees)	3,802	60
Mr. Gladstone	bush	305	14
Worcester Pearmain	bush, unpruned	1,715	81
Cox's Orange Pippin	bush	466½	22
Bramley's Seedling	standard	3,176	151
Lane's Prince Albert	bush	3,557½	169

\* The letters after the names of the apples and pears signify that the variety is (S) self-sterile, (F1) partially self-fertile, (F2) occasionally self-fertile, (F3) very rarely self-fertile.

whereas Gladstone, one of the earliest dessert varieties flowers fully a week later. The exact date at which the trees burst into blossom largely depends on the weather of the year. Generally, the end of April to the middle of May would be the average for the Midlands, but Mr. Udale found in 1914 that the period during which the earliest and latest apples began to blossom was 17th April to 29th April, and in 1920, 11th April to 2nd May. In other years it was later. The order of blossoming of the different varieties is perhaps the only satisfactory way of collating these records.

**Pears.**—With pears the interval between the date of blossoming of the earliest and latest blossoming varieties, as recorded by Mr. Udale in Worcestershire, was from 9 to 35 days, with an average of 12 days difference, whilst in Kent, Mr. Hooper found the range to be 13 days in 1908 and 18 days in 1909. Jargonelle and Beurré d'Amanlis were the first to flower and Doyenne du Comice amongst the last, so that the chances of either of the former pollinating the self-sterile Comice would be small in normal years. Winter Nellis, Clapp's Favourite, or Marie Louise, which flower only slightly in advance, should provide suitable pollen for Comice.

TABLE II.

Average Order of Blossoming and Yield of Pears at the  
Worcestershire Experiment Garden, Droitwich,  
1900 to 1920.

<i>Variety.</i>		<i>Yield in 21 years. lb.</i>	<i>Average Yield per tree per year in lb.</i>
Beurré d'Amanlis	standard	1,893	90
Maréchal de Cour	bush	447 $\frac{1}{4}$	21
Louise Bonne of Jersey A	bush	523	25
Louise Bonne of Jersey B	bush	750	36
Durondeau	bush	934	44
Beurré Superfin	bush	467	22
Marie Louise d'Uccle	bush	1,882 $\frac{1}{2}$	90
Beurré Hardy	bush	1,256	60
Williams' Bon Chrétien	standard	1,189	56
Fertility	bush	4,706	229
Pitmaston Duchess A	bush	723 $\frac{3}{4}$	34
Pitmaston Duchess B	bush	1,379	66
Clapp's Favourite	bush	1,161 $\frac{1}{2}$	55
Winter Nellis	bush	219 $\frac{3}{4}$	10
Marie Louise	bush	758 $\frac{3}{4}$	36
Doyenne du Comice A	bush	1,140 $\frac{1}{2}$	54
Doyenne du Comice B	bush	996	47



The records of Mr. Udale are set out in Table II. Mr. Hooper, from these and other observations made in the south, places the varieties in the order of flowering as:—

*Earliest* - Jargonelle, Doyenne d'Été.

*Early* - - Beurré d'Amanlis (S), Conference (F2), Marguerite Marillat (F2), Beurré Clairgeau (S), Durondeau (F3).

*Mid-Season* Louise Bonne of Jersey (S), Emile d'Heyst (S), Clapp's Favourite (S), Marie Louise d'Uccle (S), Fertility (S), Catillac (S).

*Late* - - Hessle (F3), Beurré Capiaumont (S), Dr. Jules Guyot (F3), Doyenne du Comice (S).

\* \* \* \* \*

## THE AGRICULTURAL CREDITS ACT, 1923.

### THE PROVISION OF SHORT-TERM LOANS.

**Objects.**—Under Section 2 of the Agricultural Credits Act, 1923, new facilities have been placed in the hands of farmers, small holders, allotment holders, and other agriculturists, for obtaining short-term loans.

The object of this part of the Act, is the provision of machinery easily accessible to agriculturists, under which they can obtain credit to meet such expenses as the purchase of seeds, fertilisers, feeding stuffs, the purchase of breeding and other live stock, of machinery and implements, the erection of silos, barns, fencing, etc., the purchase of fruit trees, etc.

**Outline of the Scheme.**—This will be done by establishing Agricultural Credit Societies which will be empowered, subject to certain conditions, to make loans to farmers, small holders or allotment holders, repayable within periods not exceeding five years, and which will also be entitled to assistance, in the shape of money advances from the State.

The first point to be realised by those who wish to avail themselves of the credit facilities provided by this part of the Act, is that these facilities are limited to the provision of loans made by Agricultural Credit Societies *to their members*. The formation of such a society is, therefore, a necessary precedent to the making of any loans, and it is the first step to be taken in putting the scheme into operation.

The distinctive features of an Agricultural Credit Society—such as is contemplated in the Act, are:—

1. It rests on the fundamental principle of the mutual responsibility of its members.

2. It is local—its members living within a comparatively small area and being known to each other.
3. The liability of each member is limited to the full value of the shares in the society held by him.
4. It may, subject to certain conditions, borrow money from the State for the purpose of making loans to its members, and may also, with the consent of the Minister of Agriculture, borrow from other  
• sources.

The Act provides that the share capital of a society shall consist of an unlimited number of shares of £1 each, held by members of the society, upon each of which a sum of 5s. has been paid up, and that the Minister may, subject to certain regulations, make advances to a credit society, provided that the total sum advanced to a society shall not exceed an amount equal to £1 for every £1 share held by the members upon which 5s. has been paid up. The paid-up share capital, plus this Government advance and any other sums borrowed with the consent of the Minister, may be said to form the total loanable funds out of which the society may make loans to its members. It is clear, therefore, that an essential condition for the establishment of such a society on a satisfactory basis, is that the number of members, and the number of shares held by them, should be sufficient to provide the society with adequate funds in order to make it possible for it to carry on its operations successfully.

**The Formation of a Society.**—When in any agricultural district there is a wish to form a credit society under the Agricultural Credits Act, the first step to be taken is for the promoters of the society to obtain from local agriculturists or others a sufficient number of promises to take up shares in the society to justify them in taking any further action.

In doing so it should be borne in mind that although these societies are intended solely for the assistance of persons engaged in agriculture, membership is open to any person sufficiently interested in promoting the prosperity of local agriculture to be willing to lend his capital and his credit for that purpose. In this matter the founders will have to exercise their own judgment, although the advice of officers of the Ministry will be placed at their disposal. It is obvious, however, that the larger the society, the more useful it will be, while it is hardly necessary to point out that the difficulties of initiating and carrying on a society with a very small share capital will be very great indeed, if not prohibitive.



The next step in the formation of a society will be to obtain a copy of the Model Rules which have been prepared for adoption by such societies and will be obtainable from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. These rules set out in detail the constitution of such a society, its method of operation, and the manner in which it must be conducted in order to conform with the provisions of the Agricultural Credits Act, 1923, and the Industrial and Provident Societies Acts, 1893-1913, under the latter of which Acts, an Agricultural Credit Society must be registered.

Steps must now be taken to register the society, and for this purpose a letter should be addressed to the Chief Registrar of Friendly Societies, 17, North Audley Street, W.1, asking for the necessary forms of application for registration. These application forms must be filled up in accordance with the instructions which accompany them, and returned to the Chief Registrar, together with the prescribed registration fee. The Industrial and Provident Societies Act of 1893, provides that no society can be registered which does not consist of seven members at least, and for the purpose of registry the application form must be signed by seven members and the secretary. These seven members are referred to in the Model Rules as "the original members."

The receipt by the promoters of an "acknowledgment of registry" from the Chief Registrar marks the coming into being of the society, and it is now enabled to exercise its functions both as regards lending money to its members and borrowing from the Minister. As soon as the society has thus been constituted, its first step will probably be to proceed at once with the allotment of shares in accordance with the society's rules. On allotment the 5s. per share must be paid up by the members, and it is probable that at this point the society will find it necessary to open a banking account in accordance with its rules.

For the next step it may be found most convenient at once to call a summoned general meeting, to elect a committee and officers in accordance with the rules.

**The Making of Loans.**—As regards the making of loans to members and the application for advances from the Minister, this will necessarily involve very careful consideration by the committee of the society, both as regards the method of making loans, and the appropriate time for making an application for an advance from the Minister. This is a matter of

special importance in the early stages of the society's existence. The total funds within the control of the society at the beginning of its existence are :—

1. The entrance fee of 2s. 6d. per member.
2. The paid-up share capital of 5s. per share.
3. The money advanced by the Minister of Agriculture, which is limited to a sum equal to the full value of the society's share capital for the time being issued, but on this advance the society must *pay interest* at a rate prescribed in regulations made by the Treasury. This rate is at present fixed at 5 per cent. per annum.

From the foregoing the committee of a society should at once realise that an application for an advance from the Minister should only be made when the money is required for the immediate purpose of making loans to the society's members, otherwise it will hold funds which are lying idle, but upon which it has to pay interest. Before any such application to the Minister is made, therefore, it would seem necessary for the society to consider any applications for loans from its members, and to reach a provisional decision as to the gross amount of such loans which it is prepared to make. It will then be in a position to apply to the Minister for the advance of a definite sum sufficient to enable it to make these loans, but within the limits of £1 for each £1 share held by the members.

**The Agricultural Credits Account.**—The circumstances just described in which a society makes application to the Minister for an advance in order to make loans to its members, in actual practice will not only occur once or at rare intervals, but will recur repeatedly. Moreover, when any of the loans to members, or part of the loans, are paid off, and the society has no immediate call on the surplus funds, the society will again find itself holding funds upon which it has to pay interest, but for which it has no immediate use. Under Section 2 (3) of the Agricultural Credits Act, provision is made for the opening of an account called the Agricultural Credits Account, into which shall be paid (a) such money as may from time to time be provided by Parliament towards defraying the advances and expenses of the Minister directed by this Section to be paid out of the Agricultural Credits Account, and (b) all sums received by the Minister in respect of advances made by the Minister under this Section.

This account will be administered by the Ministry of Agriculture. From what has been said above (and this is a



point which will be shown even more strongly in the Section which follows) a credit society will not be able to afford to hold any substantial sum which has been advanced to it by the Minister, unless it is immediately required for making loans to members. When, therefore, a loan, or part of a loan, to a member is repaid and any money advanced by the Minister is not immediately required for the purpose of making further loans, it will be advisable for the society to refund this money to the Minister. It is true that the rules provide that a society may invest surplus funds in the Post Office Savings Bank or any savings bank certified under the Trustees Savings Bank Act of 1863, or with the approval of a general meeting in a trustee security, but it will probably be more convenient to refund to the Minister any outstanding advance, rather than to adopt this course.

**Administrative Expenses of Society.**—This is a point which must also receive the very careful consideration of persons engaged in promoting a society. It is essential to realise that the margin of money out of which the administrative expenses of the society are to be met will necessarily be very small. In the early stages of a society the money available for this purpose will be (a) entrance fees of 2s. 6d. per member and (b) the interest on loans to members made out of the paid-up share capital of the society, and out of money advanced by the Minister, *less* the interest payable by the society in respect of the Minister's advances and the dividend on the paid-up share capital. This point may be illustrated by the following example:—

Number of members of credit society (say)	...	...	...	100
Average number of shares held by each member (say)	...	...	...	20
Total number of shares	...	...	...	2,000
Total paid-up share capital (5s. × 2,000)	...	...	...	£500
Maximum amount which may be borrowed from the Minister	...	...	...	£2,000
Total loanable funds (excluding entrance fees)...	...	...	...	£2,500

Assuming the rate of interest charged on loans to members is 6 per cent., and assuming the total loanable funds are lent to members for the first year, then—

Interest on £2,500 at 6 per cent.	...	...	=	£150	0	0
Interest payable on advance from Minister, namely 5 per cent. on £2,000	...	...	=	£100	0	0
Net income of Society from loans	...	...	=	£50	0	0
Entrance fees, 100 members at 2s. 6d.	...	...	=	£12	10	0
Total income for first year	...	...	=	£62	10	0

Out of this sum the whole administrative expenses of the society, as well as any dividend on the paid-up share capital should be met. It will therefore be clear that a society, the full value of whose share capital is £2,000, will only have a comparatively small sum out of which to meet administrative costs.

Steps are being taken with a view to organising Agricultural Credit Societies, by the Agricultural Organisation Society, 40, Broadway, Westminster, S.W.1, from whom information and assistance in the matter may be obtained. Any further information may be obtained from The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1.

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## WILTSHIRE COUNTY EGG LAYING TRIALS.

MAJOR R. F. FULLER.

THE Wiltshire County Council have recently completed their Third Annual County Egg Laying Trials, and a short account of our procedure, some of our difficulties and the results attained will be of interest, especially in those neighbourhoods where similar trials are being arranged.

The Wiltshire scheme was the first of the kind to be put into operation with the approval and support of the Ministry of Agriculture, and commenced in October, 1920. The Horticultural Sub-Committee was asked by the Agricultural Education Committee to take over work in connection with poultry instruction in the county in January, 1920, and at the Sub-Committee's first meeting it was decided to consult poultry keepers as to the steps which might be taken to improve the poultry of the county. At a conference of poultry keepers held in June, 1920, a scheme for holding laying trials in the county was strongly recommended. It will be readily understood that any such scheme requires the full support of local poultry keepers. The scheme was approved by the Ministry in August and the trials were to commence on 1st Oct., 1920, and end on 31st July, 1921.

The trials were intended to discover the standard of efficiency of the poultry in the county and to show the amount of variation; also to form a guide to the individual poultry keepers sending pens of birds as to the efficiency of their poultry, and to show those with low records the desirability of grading up their stock.

In order to be within reach of the county poultry instructor a site was selected on the outskirts of Trowbridge on soil which



admittedly was far from ideal for poultry, but which was typical of a good deal of the heavy land in the neighbourhood.

In the first year's trials 50 pens of 4 pullets each were entered and each pen was housed separately. It was found that this manner of housing was too expensive and for the second year's trials, commencing October, 1921, the houses and runs were modified and adapted so that six pens (24 birds) were housed together, thereby saving labour both in feeding and trap-nesting, and at the same time increasing the number of birds in charge of the manager from 200 to 284. The alteration did not seem to make any appreciable difference to the birds.

The first difficulty was that the houses and runs were not quite finished by the date stipulated and the date of commencement had to be postponed until 15th October. This may have contributed to the fact that 70 birds commenced to moult in the first month.

During the first winter laying was severely checked owing to the runs becoming flooded during heavy rains. Surface drains had to be cut to run the water away, and the altered houses were, in September, 1921, moved to another part of the same field. The hot summer of 1921 was hard on the houses, and during the early part of the following winter we were troubled occasionally by the wet getting in. The third year's trials were held on the same site as in the second year, and the runs, 32 yards long by 18 yards wide, were in quite good condition.

The Committee considered the results of the first year's trials quite satisfactory from an educational point of view. An average of sixty to seventy local poultry keepers per week attended at the trial ground and took a great interest in the methods of management, etc., and, in the opinion of the poultry instructor, small poultry keepers obtained greater benefit from such visits to the trial ground than from lectures. Visitors have in the past been allowed at any time on week days, but it is found that this sometimes interferes with the work of the manager and in future it is proposed to limit visits to two days per week except by appointment with the county poultry instructor.

In order to increase the interest in the trials, Cups and other prizes for pens and birds showing the best score value were provided privately from non-county funds. These prizes the Committee decided should be based on the value of eggs produced rather than the number, in order to emphasise the importance of breeding pullets that lay first grade eggs during the period of high prices. The eggs were graded in accordance with the

methods of the National Utility Poultry Society and priced each week according to the prices published in the Ministry's *Agricultural Market Report*. In the future the grading of eggs will be as decided at the Conference of representatives of the various laying trials at Harper Adams College, held on 5th April last.

The birds were fed with 1 oz. of corn per head (wheat, broken maize and oats) in their litter in the mornings and the same in the afternoons, and during the first two years a wet mash of mixed meals in the middle of the day. Dry mash hoppers were open from 10 a.m. During the third year the wet mash was omitted. The total quantity of mixed corn and meal consumed during the first year averaged 3.84 oz. per day per bird, costing 4d. per bird per week; during the second year the corresponding figures were 4 oz. per day per bird, costing  $2\frac{3}{4}$ d. per bird per week; and during the third year 4.5 oz. per day per bird, costing  $2\frac{1}{2}$ d. per bird per week. The rations were not intended to be in any way forcing and the birds were in a good healthy condition at the end of the trials.

The health of the birds has, on the whole, been quite satisfactory, the casualties averaging 9 per year. They were higher during the last year, owing to an unfortunate outbreak of roup. The following figures showing the number of birds that did not lay at all during each of the months of the third year in consequence of sickness, moulting, broodiness or immaturity may be of interest:—

<i>Month of 4 weeks.</i>										
<i>1st</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>	<i>5th</i>	<i>6th</i>	<i>7th</i>	<i>8th</i>	<i>9th</i>	<i>10th</i>	<i>11th</i>
209	211	121	85	40	14	12	14	24	21	21

With regard to selection, it is thought that our results emphasise clearly the difficulty of picking out the best layers from immature pullets. The difficulty is that birds that have commenced to lay run the risk of at least a partial moult in consequence of the changed conditions; it is difficult also to estimate the laying capability of immature birds, and if immature it seems that the change is apt to delay the commencement of laying until the price of eggs has appreciably dropped. Broodiness is frequently a handicap, particularly to some breeds. For the small breeder it is recognised that broody hens are required at the right time, but it is not advisable for the tendency to broodiness to be carried to extremes; we have in some cases had birds that have been reported broody during five and six consecutive months.

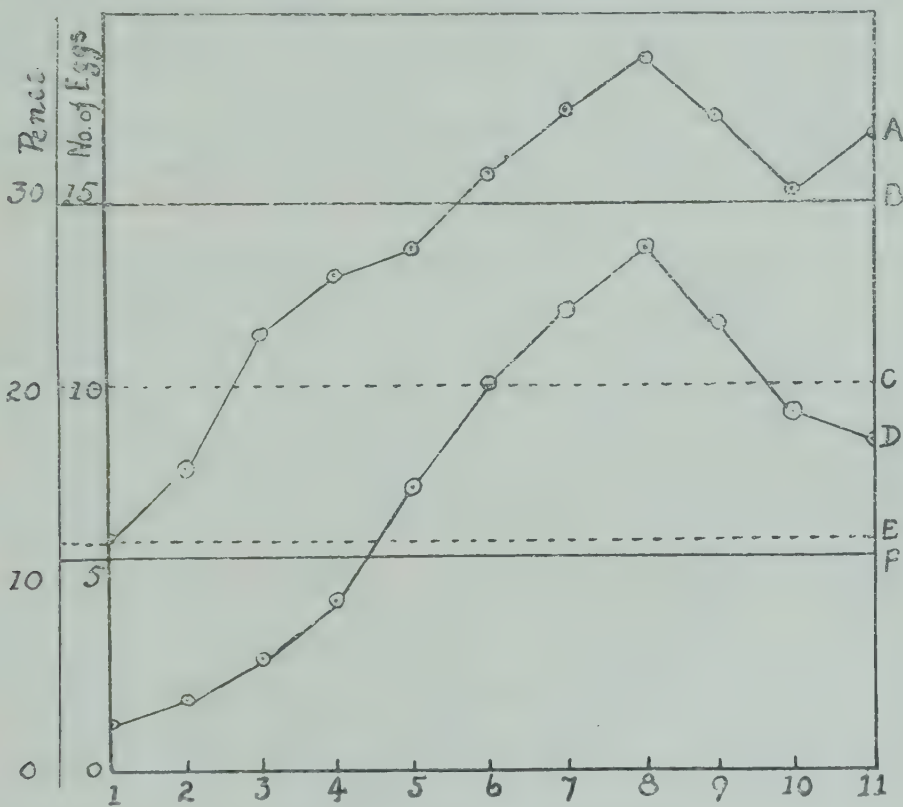
The results of the trials as regards laying capabilities, while scarcely comparable with the National Trials, indicate clearly



the extent to which local poultry could be improved. They emphasise the great importance of good laying strains and of culling the poor layers, and prove that suitable pullets can be kept profitably even on unsuitable sites. A summary of the results is given on page 659.

With regard to the importance of culling and of trap-nesting in order to cull on the surest lines, the comparisons between the 12 best pens and the 12 worst pens in the summary of results are interesting.

The average gross profit per bird, viz., difference between average cost of food and value of eggs at London Market prices, was as follows:—19s. per bird for the best pen; 14s. per bird average for the 12 best pens; 3s. per bird average for the 12 worst pens; loss 1s. 4d. per bird for worst pen. The following chart clearly shows the possibilities as regards improvement:—



Months of 4 weeks October to July.

- A.—Average Eggs per bird per month of 4 weeks of the 12 pens producing the highest number of eggs.
- B.—Average Score Value per bird per month of 4 weeks of the 12 pens producing the highest score value, 2s. 6d.
- C.—Average Value of Eggs sold locally per bird per month of 4 weeks, 1s. 8½d.
- D.—Average Eggs per bird per month of 4 weeks of the 12 pens producing the lowest number of eggs.
- E.—Average Cost of Food per bird per month of 4 weeks, 1s. 0⅓d.
- F.—Average Score Value per bird per month of 4 weeks of the 12 pens producing the lowest score value, 11½d.

Another point which the Committee consider important is that local trials on these lines give the county poultry instructor an opportunity of putting into practice the principles of feeding and management which he advocates in his itinerant lectures. This point may not be as important in counties where there is a Farm Institute, but in all branches of agricultural education there is no doubt that the efforts of instructors and advisory officers are greatly helped if they have an opportunity of putting into practice the principles they preach.

As regards the future, the Committee's scheme for next year has been approved by the Ministry, which gives a grant of two-thirds of the capital expenditure as well as two-thirds of the salary of the manager. As a result of the Committee's experience in the past it has been decided to obtain new houses of larger size designed to accommodate an increased number of birds without increased labour. The houses are being made in sections so as to be able to move to different neighbourhoods in the county from time to time. They are to be 10 ft.  $\times$  20 ft., accommodating in each half five pens of five birds each, and it is expected that the manager will be able to look after at least 300 birds.

The site selected for next year's trials is on greensand soil at West Lavington, near the Dauntsey Agricultural College, and it will be interesting to be able to show in the future the difference due to the change to a soil more suitable for poultry keeping, while in addition to the interest the trials will undoubtedly create in a new neighbourhood it is hoped that they will be also of considerable interest to the students of the Dauntsey College.

Wiltshire, unfortunately, cannot claim to be one of the leading counties as regards poultry keeping, but there is no doubt that there has been a great increase in the interest taken in the subject during the last three years. As far as is known to the county poultry instructor, there were less than 20 trap-nests in use in the county three years ago—now there are 2,000 in use. It cannot be claimed that our County Laying Trials are entirely responsible for this, but the trials are at least responsible for a share in the progress. The progress has also been helped by the formation of the Wiltshire Poultry Breeding and Egg Recording Society, formed on the lines of the scheme of Co-operative Extension Work in Agriculture and Home Economics of the State of Connecticut, U.S.A.



## SUMMARY OF RESULTS OF 3 YEARS' TRIALS.

	1st Year (40 weeks).				2nd Year (44 weeks).				3rd Year (44 weeks).			
	No. of eggs laid.		Score		No. of eggs laid.		Score		No. of eggs laid.		Score	
	1st.	2nd.	3rd.	Value.	1st.	2nd.	3rd.	Value.	1st.	2nd.	3rd.	Value.
<b>Heavy Breeds</b> —Pen of 4 Birds.				£ s. d.				£ s. d.				£ s. d.
Gold Medal ...	406	232	3	7 3 11	481	193	11	561	688	58	1	745
Silver Medal ...	423	79	0	6 12 2	437	109	0	517	662	21	0	683
Bronze Medal ...	393	140	1	6 6 5	449	155	1	529	608	34	0	642
<b>Individual Birds.</b>												
Gold Medal ...	165	25	0	2 11 3	181	16	1	197	199	5	0	204
Silver Medal ...	133	32	1	2 3 10	183	21	0	203	192	0	0	192
Bronze Medal ...	147	14	0	2 2 11	143	22	0	163	186	6	0	192
<b>Light Breeds</b> —Pen of 4 Birds.												
Gold Medal ...	457	89	1	7 12 4	568	112	0	648	503	98	1	583
Silver Medal ...	431	85	1	6 18 8	496	69	0	565	502	91	3	582
Bronze Medal ...	403	94	0	5 18 5	516	54	0	570	481	69	1	550
<b>Individual Birds.</b>												
Gold Medal ...	144	2	0	2 2 10	142	61	0	162	167	11	0	178
Silver Medal ...	124	23	0	2 2 0	147	41	0	167	165	0	0	165
Bronze Medal ...	123	37	0	2 0 0	131	49	0	151	153	13	0	166
AVERAGE OF 12 BEST PENS ...	395	133	3	6 6 0	460	130	2	532	535	73	2	597
AVERAGE OF ALL PENS ..	291	170	10	4 16 2	280	144	7	347	325	152	5	391
AVERAGE OF 12 WORST PENS	171	254	26	3 9 6	101	207	6	169	111	236	6	181

TABLE II.

Breed.	Breed Averages—No. of Eggs laid per Bird.		
	1920-21.	1921-22.	1922-23.
Anconas ...	107	114	100
White Leghorns ...	86	113	125
White Wyandottes ...	90	105	125
Rhode Island Reds ...	92	118	126
Light Sussex ...	103	80	90

## NOTES ON MANURES FOR OCTOBER.

SIR JOHN RUSSELL, D.Sc., F.R.S.,  
*Rothamsted Experimental Station, Harpenden, Herts.*

**Town Refuse Experiments.**—Some interesting experiments are being made this year at Rothamsted to compare the effect of ashpit refuse from towns (already described in this *Journal*)\* with town stable manure. The crop grown is mangolds, and the manures were applied all at the same rate, namely, 15 tons per acre. The difference in cost was considerable; the ashpit refuse cost nothing, while the town stable manure cost 3s. 9d. per ton; in both cases, however, there was carriage and carting to be paid for, making a total of 10s. per ton on the farm for the stable manure and 6s. 3d. per ton for the refuse. Up to the present there is no difference whatever to indicate that the ashpit refuse will be inferior to stable manure. The condition of the soil is just as good, there has been an equally good growth of plant and equally few gaps. It still remains to be seen whether ashpit refuse will last as well as stable manure, but up to the present the indications are favourable.

It is not the purpose of these notes to “boom” town waste as a manure. We have already heard of one case where an enterprising town authority is inviting farmers to pay 2s. 6d. per ton free on rail for its refuse. A price of this kind cannot be justified. Seeing that the town authority must dispose of its refuse somehow, it is only reasonable that they should put it on rail free of charge, and indeed they should help to bear the burden of the carriage. Five or 6s. per ton on the farm is as much as town refuse is likely to be worth at present prices of other manures.

**Spring Dressings.**—At Rothamsted this year spring dressings of nitrogenous fertilisers to corn crops have shown up quite well, and it has again appeared, contrary to some of the previous results, that the later applications have been rather more favourable to crop yields than the earlier ones. A great deal must depend on the soil and season, and it is desirable that much fuller information than we have at present should be obtained, for it is a little difficult to understand the results as they stand. The present position is that one can safely recommend spring dressings as being likely to increase winter corn crops, but we are

\* Nov., 1922, p. 685; Dec., 1922, p. 838; Jan., 1923, p. 944.



not yet in a position to state exactly what is the best time for applying them. On the other hand, it appears that the top dressing given to potatoes was not as effective as the same quantity of dressing applied with the seed. In 1922, for example, the potatoes receiving no nitrogen but only the basal dressing of potash phosphates and dung gave 6.1 tons per acre. The addition of 3 cwt. of sulphate of ammonia with the seed raised this to 9.7 tons, but when the 3 cwt. were divided into two dressings of  $1\frac{1}{2}$  cwt. each, one applied with the seed and the other given later as top dressing, the yield was only 8.6 tons per acre.

**Potash as a Fertiliser for Mangolds.**—Barnfield plots this year showed striking advantages from potash dressings, and from the comments made by agricultural visitors it seems clear that many farmers do not appreciate the importance of potash for this particular crop. The plants to which no potash was given are not as large nor as healthy as those receiving potassic fertilisers, even though they have been pretty well treated with farmyard manure. There is a tendency for the leaves to be darker and more crinkly, also a tendency for orange streaks to appear in the stems. Provision should always be made for the mangold crop to receive a sufficient dressing of kainit or muriate of potash. Suitable amounts are 5 cwt. of kainit, or  $1\frac{1}{2}$  cwt. of muriate of potash, or 3 cwt. of French extra kainit. In many cases salt is a useful addition also.

**Mineral Phosphates.**—Mineral phosphates are attracting a good deal of attention at present, and a number of experiments are being made in different parts of the country to ascertain their value to farmers.

In a set of experiments with swedes in Radnorshire,\* Mr. David Thomas reports the following yields:—

Plot 7. Control (no phosphate)	8 tons per acre.
Plot 1. Superphosphate	12 tons „
Plot 6. Basic Slag	12.7 tons per acre.
Plot 4. Gafsa Phosphate	10.9 tons „

from which it appears that although Gafsa is not as good as superphosphate or slag, it nevertheless served a useful purpose. Other mineral phosphates were not quite so good.

There is considerable evidence that the phosphates must be very finely ground to ensure good results.

**The Proper Time to use Farmyard Manure.**—A correspondent asks what is the best time for putting farmyard manure

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\* Radnorshire County Council, Report on Agricultural Work, 1923.

on the land, and on our informing him that he should as a rule apply it in autumn or winter if in the dryer parts of England, but that he can apply it in spring if the winter is mild and wet, replies that he cannot readily draw it out in winter on his heavy land, and if he held it over till the following autumn he would have to wait for a long time ahead before deriving any benefit from it.

The advice to apply farmyard manure in autumn or winter must, of course, be modified whenever circumstances would make the plan more costly than the saving would justify. The clay farmer cannot get his manure on to the land as easily as is possible for anyone farming on lighter soil. If the land happens to be dry in the latter part of the winter, he can readily apply the manure for the mangold crop, but if it is wet there is more difficulty. He could, however, often use it with advantage on the clover leys so long as he does not cut them up too badly. Whatever plan he makes it must be admitted that a heavy land farmer might easily have difficulty in using farmyard manure after February, and might then have to store it. A certain number of cow-keepers are now cutting up straw into short lengths of about 4 in., and this practice certainly improves the manure and facilitates decomposition in the soil, so that later dressings can be given.

**Selection of Potash Fertilisers: Present Position.**—Experimental work is now proceeding at a number of centres in regard to potash fertilisers, and precise information is being accumulated which will enable the farmer to make a selection suitable to his farm and his crops. The present position is broadly as follows:—

1. Kainit can be used for mangolds on practically all soils: for cereals and leguminous crops on light chalky soils. The amount necessary depends on the composition of the fertiliser, but would be 3 to 5 cwt. per acre of ordinary kainit, or proportionately less of the French extra kainit containing 20 per cent. of  $K_2O$ .

2. Muriate of potash can be used for practically any agricultural crop or any soil. It usually gives as good a crop as sulphate of potash, but may not give as good a quality.

3. Sulphate of potash is safest for potatoes where quality is a consideration; it can also be used for horticultural purposes, glass-houses, etc., and is generally associated with good quality of



produce. The following results were obtained at Kirton in 1922:—

Manures.	Yield per Acre.			Total (Ware, Seed and Chats).		
	T.	c.	lb.	T.	c.	lb.
1. No Potash ... ..	4	9	24	6	4	80
2. Sulphate of Potash ...	7	19	104	10	0	16
3. Muriate of Potash ...	8	1	70	10	2	70
80% Ordinary Commercial						
4. Muriate of Potash 97%	8	3	64	10	4	104
5. Kainit 14% ... ..	6	10	56	8	3	0
* * *	*	*	*	*	*	*

## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending September 12th.				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ... ..	13.10	13.15	13.10	12.17	16. 7
" " Lime (N. 13 per cent.) ... ..	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 7*	13. 7*	13. 7*	13. 7*	(N)12.10
" " " neutral (A. 25¾ per cent.)	14.10*	14.10*	14.10*	14.10*	(N)13. 8
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	1.14	2. 8
" (Pot. 14 per cent.) ... ..	2. 2	...	2.10	2. 5	3. 3
Sylvinite (Pot. 20 per cent.) ... ..	...	...	...	2.10	2. 6
Potash Salts (Pot. 30 per cent.) ... ..	...	...	...	3.10	2. 4
" (Pot. 20 per cent.) ... ..	...	...	...	2.10	2. 6
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 0	8. 0	7. 0	2.10
Sulphate of Potash (Pot. 48 per cent.) ...	...	...	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.) ... ..	...	...	...	3.12§	2. 1
" (T.P. 30 per cent.) ... ..	...	...	...	3. 0§	2. 0
" (T.P. 26 per cent.) ... ..	2.13§	2.10§	...	...	...
" (T.P. 24 per cent.) ... ..	2. 9§	2. 4§	2. 2§	...	...
" (T.P. 20-22 per cent.) ... ..	...	2. 1§	...	2. 7§	2. 4
" (T.P. 18 per cent.) ... ..	2. 3§	...	1.15§	...	...
Slag Phosphate (T.P. 60 per cent.) ... ..	...	...	...	5.12	1. 9
Superphosphate (S.P. 35 per cent.) ...	3.17	...	3.15§	3. 7	1.11
" (S.P. 30 per cent.) ... ..	3.10	...	3. 7§	3. 0	2. 0
Bone Meal (T.P. 45 per cent.) ... ..	9.10	...	8.15	8.10	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	...	6.15	6.10	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.10	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

## MONTHLY NOTES ON FEEDING STUFFS.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),  
*Animal Nutrition Institute, Cambridge University.*

**Milk Production of Sows.**—The chief care of the successful pig feeder is to keep the breeding sows in good condition both during pregnancy and particularly during the suckling period, so that the piglings when weaned are in a healthy thriving condition. In order to obtain a quick maturing, good quality finished porket or bacon pig it is essential that the weaned pigling should be well nourished during the suckling period.

The capacity of a sow to raise large well-developed litters depends upon her ability to produce the necessary milk. Carlyle at the Wisconsin Experiment Station, and Braxton and Jones, working at the Purdue University under the direction of Professor W. W. Smith, have studied this problem, working with Berkshires, Razor-backs, Poland Chinas and Durocs. The method adopted was to keep the sow and litter separate, and to weigh the piglings immediately before and after each nursing, thus obtaining a measure of the milk produced. The results of these experiments showed that there is considerable variation in the milk capacity of individual sows, as there is in ordinary milch cows, and, as would be expected, the sows which produced the most milk produced the largest litters. The number of piglings in the litter and the weight at weaning time therefore gives a very good indication of the milk capacity of the sow. In the experiments in question the average daily production of milk per sow, on a 10 weeks suckling period, worked out at 5.53 lb., giving a total production of 387 lb. of milk during the suckling period. The amount of milk given by different sows varied from 3.39 lb. to nearly 8 lb. daily. It will be seen that during the suckling period the sow gives half a gallon of milk a day, which fact emphasises the importance of feeding the sow well during the suckling period on materials rich in milk-producing constituents. Sow's milk is considerably richer in protein, ash and fat than cow's milk, the total solids of sow's milk being 19 per cent. as compared with 13.6 per cent. in cow's milk. According to Henry and Morrison the percentage composition of cow's milk and sow's milk is as follows:—

		<i>Solids.</i>		<i>Fat.</i>		<i>Protein.</i>		<i>Milk sugar.</i>		<i>Ash.</i>
Cow's milk	...	13.60	...	4.4	...	3.5	...	5.0	...	0.7
Sow's milk	...	19.00	...	6.7	...	5.9	...	5.4	...	1.0



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.						
	s.	lb.	s.	£ s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British - - -	—	—	9/4	9 7	0 15	8 12	71·6	2/5	1·29	
Barley, British Feeding - - -	—	—	7/8	7 13	0 12	7 1	71	2/-	1·07	
„ Danubian „ - - -	29/6	400	8/3	8 5†	0 12	7 13	71	2/2	1·16	
Oats, English, White - - -	—	—	10/6	10 10	0 13	9 17	59·5	3/4	1·78	
„ „ Black and Grey - - -	—	—	8/4	8 7	0 13	7 14	59·5	2/7	1·38	
„ Canadian No. 2 Western - - -	28/9	320	10/1	10 2	0 13	9 9	59·5	3/2	1·70	
„ No. 3 „ - - -	27/9	„	9/9	9 15	0 13	9 2	59·5	3/1	1·65	
„ Feed „ - - -	27/6	„	9/8	9 13	0 13	9 0	59·5	3/-	1·61	
„ American - - -	24/-	„	8/5	8 8	0 13	7 15	59·5	2/7	1·38	
„ Argentine - - -	24/-	„	8/5	8 8	0 13	7 15	59·5	2/7	1·38	
Maize, American - - -	43/6	480	10/2	10 3†	0 13	9 10	81	2/4	1·25	
„ Argentine - - -	35/9	„	8/4	8 7	0 13	7 14	81	1/11	1·03	
Beans, Rangoon - - -	—	—	7/4	7 7†	1 11	5 16	67	1/9	0·94	
Millers' offals:—										
Bran, British - - -	—	—	—	5 15	1 6	4 9	45	2/-	1·07	
„ Broad - - -	—	—	—	6 10	1 6	5 4	45	2/4	1·25	
Middlings, Coarse, British - - -	—	—	—	8 7	1 2	7 5	64	2/3	1·20	
Pollards, Imported - - -	—	—	—	5 15†	1 6	4 9	60	1/6	0·80	
Meal:—										
Barley Meal - - -	—	—	—	9 12	0 12	9 0	71	2/3	1·34	
Maize „ - - -	—	—	—	11 0	0 13	10 7	81	2/7	1·38	
„ Germ Meal - - -	—	—	—	9 0	0 18	8 2	85·3	1/11	1·03	
„ Gluten-feed - - -	—	—	—	8 12	1 6	7 6	75·6	1/11	1·03	
Locust Bean Meal - - -	—	—	—	8 0	0 9	7 11	71·4	2/1	1·12	
Bean Meal - - -	—	—	—	12 10	1 11	10 19	67	3/3	1·74	
Fish „ - - -	—	—	—	17 0	4 6	12 14	53	4/10	2·59	
Linseed - - -	—	—	—	20 12	1 10	19 2	119	3/3	1·74	
„ Cake, English 9% - - -	—	—	—	11 13	1 17	9 16	74	2/8	1·43	
Cottonseed Cake, English 5½% - - -	—	—	—	7 12	1 14	5 18	42	2/10	1·52	
„ „ Egyptian 5½% - - -	—	—	—	7 5	1 14	5 11	42	2/8	1·43	
Decorticated Cottonseed Meal 7% - - -	—	—	—	11 12	2 13	8 19	71	2/6	1·34	
Coconut Cake 6% - - -	—	—	—	8 10	1 10	7 0	73	1/11	1·03	
Ground Nut Cake 7% - - -	—	—	—	8 10	1 15	6 15	56·8	2/5	1·29	
Palm Kernel Cake 6% - - -	—	—	—	5 10†	1 3	4 7	75	1/2	0·62	
„ „ Meal 2% - - -	—	—	—	5 0	1 4	3 16	71·3	1/1	0·58	
Feeding Treacle - - -	—	—	—	6 5	0 8	5 17	51	2/4	1·25	
Brewers' Grains:—										
Dried Ale - - -	—	—	—	6 2	1 4	4 18	49	2/-	1·07	
„ Porter - - -	—	—	—	5 15	1 4	4 11	49	1/10	0·98	
Wet Ale - - -	—	—	—	1 1	0 9	0 12	15	0/10	0·45	
„ Porter - - -	—	—	—	0 18	0 9	0 9	15	0·7	0·31	
Malt Culms - - -	—	—	—	6 10	1 13	4 17	43	2/3	1·20	

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of August and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 12s. 7d.; P<sub>2</sub>O<sub>5</sub>, 4s. 4d.; K<sub>2</sub>O, 2s. 4d.

The nutritive ratio of sow's milk on the basis of the composition given above works out at 1 : 3.5, so that it becomes necessary to feed the brood sow on a mixture having a fairly narrow ratio, and in view of the demand upon the sow for milk, a very liberal amount of food should be given. This is in accord with the experience of practice, it being commonly held by all successful pig breeders that you cannot do a brood sow too well during the suckling period. The practical advice which can be given as the result of the above experiments is: Breed for milk capacity from the sows which give large litters and finish them well as weaned piglings; feed the sows well on a mixture of meals to which a protein-rich feeding stuff has been added; and, above all, do not stint the brood sows for food during the suckling period, since a stinting policy at this time has to be more than paid for at a later period.

FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.E. d.
	£ s	£ s.	£ s.			
Wheat - - - - -	7 12	0 15	6 17	71.6	1 11	1.03
Oats - - - - -	6 7	0 13	5 14	59.5	1 11	1.03
Barley - - - - -	7 8	0 12	6 16	71.0	1 11	1.03
Potatoes - - - - -	1 18	0 3	1 15	18.0	1 11	1.03
Swedes - - - - -	0 15	0 2	0 13	7.0	1 11	1.03
Mangolds - - - - -	0 14	0 2	0 12	6.0	1 11	1.03
Good Meadow Hay - -	3 15	0 13	3 2	31.0	2 0	1.07
Good Oat Straw - - -	2 0	0 6	1 14	17.0	2 0	1.07
Good Clover Hay - - -	4 4	1 0	3 4	32.0	2 0	1.07
Vetch and Oat Silage - -	1 15	0 7	1 8	14.0	2 0	1.07

\* \* \* \* \*

THE Director of the Rothamsted Station wishes to remind farmers and others interested in agriculture that the field experiments on the manuring of root crops conducted at Rothamsted provide at this time of the year a very striking series of demonstration plots. The most important of these experiments are:—

- Farmers' Visits to Rothamsted Experimental Station.**
- (1) *Potatoes*
    - (a) The effects of various potash manures (sulphate of potash, muriate of potash, kainit, sylvinit, etc.).
    - (b) The effect of increasing dressings (from nothing up to 4½ cwt. per acre) of sulphate of ammonia in a complete fertiliser on the yield and quality of the tubers.
    - (c) Comparative trials with certain new fertilisers.
    - (d) Comparisons of yields from seed potatoes fresh from Scotland with those from once grown seed.



(2) *Mangolds*

(a) The fertilising value of certain types of town refuse as compared with dung.

(b) Continuous mangolds (47th year). Showing the effects of various manurial schemes.

(3) *Swedes*

The use of sulphate of ammonia as a top dressing to supplement phosphates, potash, and dung applied at sowing time.

(4) *White Turnips*

Comparisons of various green manuring crops (mustard, tares, trifolium, etc.), as a preparation for roots. It is desired to find out how far dung can be substituted by green crops ploughed in.

The Secretary of the Station will be glad to arrange for farmers' parties of any size to be conducted round the experimental plots at any time before lifting. In cases, however, where it is difficult to fix a date in advance, farmers are invited to go at their own convenience, and the necessary arrangements will be made on arrival. At least three hours should be allowed for a tour round the farm. Lunch and tea can readily be obtained in Harpenden. The Midland Railway Station (Harpenden) is about half a mile from the Laboratory and the Great Northern Station about two miles. Farmers going by road will find the Laboratory on the west side of Harpenden Common.

\* \* \* \* \*

## REPLIES TO CORRESPONDENTS.

**Formaldehyde and Fruit Tree Pests.**—E.T. asks whether formaldehyde is of any use against insect pests or fungi of fruit trees.

*Reply:* It is of no use against insect pests of fruit trees and there do not appear to be any records of it being used against fruit fungi.

**Digestibility Trials of Feeding Stuffs.**—F.S. asks whether the figures given for digestibility in the Ministry's Miscellaneous Publication No. 32 (*Rations for Live Stock*) are theoretical or based on actual trials, and if the latter, what animals were used.

*Reply:* The figures given are average figures from experiments carried out with cattle or sheep, which differ very little from one another in their power of digestion. Pigs differ from cattle and sheep appreciably but not very greatly; the number of digestibility experiments which have been made with pigs is not very large. Tables of digestibility of foods when fed to pigs are given in Kellner's "Scientific Feeding of Animals," Henry & Morrison's "Feeds and Feeding," and Armsby's "Principles of Animal Nutrition."

**Sainfoin.**—G.R. asks whether it is a fact that sainfoin should not be sown on the same land without a long interval intervening.

*Reply:* In the absence of adequate evidence to the contrary it would be advisable to respect the general opinion to the extent at least of allowing the land to be free of the crop for the same length of time as it has borne it.

**Bacterial Fertilisers.**—H.Q. asks for information as to bacterial fertilisers for use with cereals.

*Reply:* In a lecture, delivered at Weimar in June, 1921, Professor Lemmermann, of Berlin, divided bacterial manures into two classes:—(1) those intended for inoculation of leguminous plants; (2) those intended for use with other plants. As regards the latter he concluded:—"All the inoculation manures advertised for use with other than leguminous plants, with corn, root crops, potatoes, etc., cannot accordingly be recommended, but, on the basis of our present knowledge, a warning must be given against their employment."

**Lime in Basic Slag.**—J.P. asks the percentage of free lime in present-day slag.

*Reply:* While an analysis of old-fashioned slag would probably show from 40–50 per cent. of lime only a very small proportion of this would be free lime. The proportion of free lime in present-day slag is likewise very small, probably 2 or 3 per cent.

**Oil from Home-grown Linseed.**—K.O. asks about oil-content of home-grown linseed.

*Reply:* The oil-content of linseed forms the subject of a paper in Vol. VII (March, 1915) of the Journal of Agricultural Science, and of an article in this *Journal*, February, 1916. In this article reference is made to the prevalence of a belief that "linseed grown at home contains appreciably less oil than that which is usually imported." This belief is shown by figures of trials to be without foundation.

\* \* \* \* \*

**Foot-and-Mouth Disease.**—*Bedfordshire.*—No further outbreaks having occurred, all general restrictions imposed in connection with this group of outbreaks were withdrawn on 9th September.

*Hampshire (Alton district) and Surrey.*—There have been no fresh developments in this area and the restrictions were withdrawn on 15th September.

*Yorkshire West Riding.*—Disease was found to exist at Templeborough, Rotherham, on 27th August, the affected animals consisting of pigs kept in a hotel yard. There have been no further developments in this area, and the usual restrictions which were imposed were withdrawn on 27th September.

*Lancashire.*—On 28th August, an outbreak occurred at Norbreck, Blackpool, and on 30th August, a further outbreak occurred at Cloughton, Garstang, which was within the original prohibited area, but at its extremity. It was therefore necessary to extend the area under restrictions. In the extended area, further outbreaks occurred, namely:—on 3rd September at Carleton, Poulton-le-Fylde (two), and Bispham, on 6th September at Bispham and at Carleton, on 7th September at Leyland, on 8th at Carleton, on 13th at Rossall, and on 18th at Bispham.

*Cheshire.*—On 4th September, disease was confirmed at Shavington near Crewe in animals which had arrived at Fleetwood from Ireland on 28th August. These cattle had been unloaded at Crewe on 1st September and as Crewe market was held on 3rd September the possibility of further outbreaks arose. Arising out of the distribution of animals via Crewe, further outbreaks were confirmed at Wistaston on 6th September in cattle which had used the same railway siding as the Shavington animals, on 7th September at Weston, on 8th at Calveley and on 9th at Basford, Nantwich (two), and Wistaston.



In all cases the animals had been purchased in Crewe market or had passed through the Crewe loading docks, subsequently, further outbreaks have occurred in the vicinity of those referred to, bringing the total in this area to 22.

*Bucks.*—The initial outbreak in this area at Wotten Underwood on 7th September, was directly due to the movement of sheep from Crewe. This outbreak gave rise to others in the vicinity on 10th September at Waddesdon and Wotten Underwood, and on 13th and 14th September at Kingswood, Aylesbury.

*Southampton district.*—Commencing on 4th September, a fresh series of outbreaks was brought to light by the confirmation of disease at West End, Southampton. Further outbreaks occurred at West End on 5th, 6th, 7th and 10th September, all the premises being in close proximity to those on which disease first appeared.

*Devonshire.*—Four outbreaks have been confirmed in the Torquay district, two on premises in the occupation of the same owner, at Torquay and Cockington on 6th September, and two on 7th and 12th September at Cockington, which were probably due to the movement of animals from one of the former outbreaks.

Following upon the initial Cheshire outbreak, the existence of disease was confirmed on the Landing Place for Irish animals at Fleetwood on 4th September, and the Ministry accordingly prohibited entirely the landing of animals from Ireland. Arrangements were immediately made for tracing the affected animals back to the place of origin in Ireland, but exhaustive enquiries failed to indicate that foot-and-mouth disease existed in Ireland, and the Ministry reached the conclusion that disease was introduced into the Landing Place from one of the local centres of infection in the Blackpool district.

In the circumstances the Ministry issued an Order on 7th September, taking immediate effect, withdrawing the prohibition on the landing of animals from Ireland, and permitting importation under the usual conditions except as regards certain ports in contiguity to outbreaks.

**Map of Wart Disease Infected Areas.**—The Ministry has issued a map showing the principal districts which are scheduled as infected areas under the Wart Disease of Potatoes Order of 1923. This map will be of particular value to dealers in potatoes, since the movement of potatoes from the infected areas to other districts is prohibited except as regards potatoes of immune varieties for ware purposes. A list of the areas is appended to the map, copies of which can be obtained from the Offices of the Ministry, 10, Whitehall Place, London. S.W.1, price 6d., post free.

**List of Potato Varieties.**—The Ministry is informed that a list of the names of all the known varieties of the potato, together with their synonyms, has been compiled by the Board of Agriculture for Scotland. The list comprises 1,300 names, and indicates whether the varieties are immune from or susceptible to wart disease, in all cases where that fact is known. There is no doubt that the publication should be of considerable value to potato growers, merchants, and to the trade in general. Copies can be had on application to the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

**National Rat Week.**—The week beginning Monday, 5th November, 1923, has been fixed by the Ministry as "Rat Week." The object is to secure by organised and simultaneous action throughout the country the largest possible destruction of rats. It also affords an opportunity of calling public attention to the damage caused by them and of reminding the public that it is the duty of all occupiers of premises infested with rats and mice to destroy these pests. Where they fail to do so voluntarily, the Local Authority may put into operation their powers under the Rats and Mice (Destruction) Act, 1919.

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## NOTICES OF BOOKS.

**A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States.**—(R. B. Thomson and H. B. Sifton: Univ. of Toronto Press, 1922). The authors are to be congratulated on the production of an excellent and nicely illustrated little work, mainly intended, it is true, for readers in Canada and the United States, but giving useful information on many plants which are also common in Britain. The plan of the book is to deal in turn with plants dangerous when included in hay and coarse feeds, plants dangerous in pasture or on the range, those dangerous in ground feeds, and those which are rarely observed to cause death in animals. Each species is dealt with with reference to its relationship to Canadian and United States farming, and the information given is practical and clearly written. It is worthy of notice that whereas so many books nowadays are cheaply produced the work under notice is well printed on art paper and enclosed within a limp linen cover—a pleasure to handle.

**The Story of the Maize Plant.**—(Paul Weatherwax, Chicago: Univ. of Chicago Press, \$1.75). This excellently produced little book is really of chief interest for American readers, or those in the numerous countries where maize can be successfully ripened and is extensively grown. Certain parts of it, however, are of interest to British readers, for one chapter deals with the products and uses of the maize plant, though the space devoted to it as a food for live stock is but a brief sketch. The same remark may be made of the references to ensilage and pasturing of the crop. The volume nevertheless deals systematically with the origin and botanical characteristics of the plant, its cultivation and growth, the green plant and the seed, heredity, and breeding, and generally with maize in its relation to man, forming a clearly written and attractive account of one of the world's most wonderful food plants. Maize has become an important grain food on British farms, and the green crop where successfully grown in the southern counties is a highly valuable fodder, especially for milch cows or pigs, while it may very successfully be stored in the form of silage. Any book therefore that will help us to understand it better is welcome, and Weatherwax brightens his story with apt references to the legendary origin of maize as a food crop, until in the words of Bayard Taylor it became

"The annual storehouse of a nation's need,  
From whose abundance all the world may feed."



## ADDITIONS TO LIBRARY.

**Agriculture, General and Miscellaneous.**

- Dunlop, J.*—American Agriculture and Some Hints Therefrom. (8 pp.) Glasgow : Scottish Agricultural Publishing Co., 1923, 6d. net. [63.73.]
- Coulter, M. C.*—Outline of Genetics with Special Reference to Plant Material. (211 pp.) Chicago : University Press; Cambridge : University Press, 1923, 7s. 6d. [575.1(02).]
- Griffith, J. J.*—Lime and Liming. (9 pp.) Bath : Herald Press, 1923. [63.15.]
- National Institute of Agricultural Botany.*—Methods of Seed Analysis. (15 pp.) Cambridge, 1923, 1s. [63.1951.]

**Field Crops.**

- Leppan, H. D., and Bosman, G. J.*—Field Crops in South Africa. (360 pp.) Johannesburg : Central News Agency, Ltd., 1923, 21s. net. [63.3(02); 63(68).]
- Stapledon, R. G.*—The Cultivation and Varieties of Oats. (17 pp.) Bath : Herald Press, 1923. [63.314(04).]
- Weatherwax, P.*—The Story of the Maize Plant. (260 pp.) Chicago : University Press, 1923, \$1.75. [63.315(02).]
- Stuart, W.*—The Potato : Its Culture, Uses, History, and Classification. (525 pp.) Philadelphia and London : J. B. Lippincott Co., 1923, 12s. 6d. [63.512(02).]
- Scotland Board of Agriculture.*—Miscellaneous Publications No. 3 :—The Maintenance of Pure and Vigorous Stocks of Varieties of the Potato. (64 pp.) Edinburgh, 1923, 1s. net. [63.512(04).]
- Colorado Agricultural Experiment Station.*—Bulletin 281 :—Methods of Handling Hay in Colorado. (39 pp.) Fort Collins, 1923. [63.1982.]

**Horticulture.**

- Mourre, C.*—La Lavande Française : sa Culture, son Industrie, son Analyse. (170 pp.) Paris : Gauthier-Villars et Cie., 1923. [63.345.]
- U.S. Department of Agriculture.*—Farmer's Bulletin 1320 :—The Production of Cucumbers in Greenhouses. (29 pp.) Washington, 1923. [63.513(04).]

**Plant Diseases.**

- Food Investigation Board, Department of Scientific and Industrial Research.*—Special Report No. 12 :—Brown Heart—A Functional Disease of Apples and Pears, *Franklin Kidd and Cyril West*. (36 pp. + xix plates.) London : H.M. Stationery Office, 1923, 4s. 6d. net. [63.21.]

**Live Stock.**

- Corrie, F. E.*—The Mineral Needs of Farm Stock. The Supply of Lime and Phosphate to Animals. (8 pp.) The Author, Star Cottage, Lingfield, Surrey, 1923, Free. [612.394.]
- Rowlands, M. J.*—Open-Air Pig Breeding. Scientific and Practical. (245 pp.) London : Vinton & Co., 1923, 7s. 6d. net. [63.64(02).]
- Iowa Agricultural Experiment Station.*—Bulletin 208 :—Self-Feeders for Swine. (pp. 97-143.) Ames, 1922. [63.6 : 69.]

**Dairying and Food.**

- Leeds University and the Yorkshire Council for Agricultural Education.*—Report 131 :—Clean Milk and its Production. (7 pp.) Leeds, 1923. [614.32.]
- Illinois Agricultural Experiment Station.*—Bulletin 244 :—The Feed Cost of Milk and Fat Production as Related to Yields. (pp. 551-573.) Urbana, 1923. [63.714.]
- Illinois Agricultural Experiment Station.*—Bulletin 241 :—Comparative Expense of Mechanical and Hand Milking. (pp. 491-506.) Urbana, 1923. [63.713; 63.714.]
- Food Investigation Board, Department of Scientific and Industrial Research.*—Special Report 13 :—Studies in Sweetened and Unsweetened (Evaporated) Condensed Milk. (103 pp.) London : H.M. Stationery Office, 1923, 4s. net. [63.715.]
- Ministry of Health.*—Reports on Public Health and Medical Subjects No. 17 :—Notes on the Pasteurisation of Milk. (14 pp.) London : H.M. Stationery Office, 1923, 2d. net. [63.717.]

**Poultry and Bees.**

*Powell-Owen, W.*—Selecting the Layers.—Describing in Detail the Internal Mechanism of the Laying Hen and the "Powell-Owen" Score-Card System of Hand-grading. (330 pp.) Hampstead, London: Powell-Owen Poultry Publications, 1923, 10s. 6d. [63.65(02).]

*Iowa Agricultural Experiment Station.*—Bulletin 202:—Breeding Rhode Island Reds for Type and Egg Production. (pp. 9-24.) Ames, 1922. [63.651(04).]

*Betts, A. D.*—Practical Bee Anatomy with notes on the Embryology, Metamorphoses and Physiology of the Honey Bee. (88 pp.) Benson, Oxon: Apis Club, 1923. [63.81.]

**Economics.**

*Venn, J. A.*—Foundations of Agricultural Economics. (412 pp.) Cambridge: University Press, 1923, 16s. net. [338.1(02); 63(09).]

*Bensusan, S. L.*—The Town versus the Countryside. (23 pp.) London: P. S. King, 1923, 6d. [338.1(04).]

*Wood, L. S.*—The Principles and Practice of Farm Valuations. 4th Edition. (326 pp.) London: Estates Gazette, 1923, 12s. 6d. [63.191; 347(a).]

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## SELECTED CONTENTS OF PERIODICALS.

**Agriculture, General and Miscellaneous.**

Farm Stock-Taking, *J. M. Adams.* (Jour. Dept. Agr., Ireland, Feb., 1923, pp. 360-371.) [657.]

The Uses of Costing, *C. S. Orwin.* (Jour. Land Agents' Soc., Sept., 1923, pp. 435-446.) [657.]

Farm Profits and Farm Losses, *A. G. Ruston.* (Scottish Jour. Agr., July, 1923, pp. 287-296.) [63(42); 338.58.]

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**Plant Pests and Diseases.**

Farm Pests—Rats, *J. Ritchie.* (Scottish Jour. Agr., July, 1923, pp. 296-309.) [63.269.]

Notes on the Control of "Cutworms" by Poisoned Bait, *J. C. F. Fryer* and *R. Stenton.* (Ann. App. Biol., July, 1923, pp. 241-252.) [63.27.]

The Turnip Gall Weevil, *Ceuthorrhynchus Pleurostigma*, Marsh, *P. V. Isaac.* (Ann. App. Biol., July, 1923, pp. 151-193.) [63.27.]

A Study of the Internal Browning of the Yellow Newtown Apple, *A. J. Winkler.* (Jour. Agr. Res., Apr., 1923, pp. 165-184.) [63.21.]

Apple Flesh-Collapse or Brown-Heart. Control Measures for Orchard and Cool Store, *R. Waters.* (N.Z. Jour. Agr., July, 1923, pp. 32-41.) [63.21.]

Investigations on the Leaf-Roll and Mosaic Disease of the Potato. *P. A. Murphy.* (Jour. Dept. Agr., Ireland, May, 1923, pp. 20-34.) [63.23.]

**Live Stock.**

The Rearing of Bacon Pigs for Bacon Factory Purposes, *T. Hamilton.* (Rhodesia Agr. Jour., Aug., 1923, pp. 412-425.) [63.64.]

Fish Meal and Tainted Bacon, *J. B. Orr* and *A. Chrichton.* (Scottish Jour. Agr., July, 1923, pp. 279-287.) [63.64 : 043.]



# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOVEMBER, 1923

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## NOTES FOR THE MONTH.

THE Departmental Committee on Distribution and Prices of Agricultural Produce has issued its fourth Interim Report\*

**Distribution and  
Prices of Cereals,  
Flour and Bread.**

dealing with cereals, flour and bread. This is the last section of the Committee's inquiries, and a final report, reviewing the general results of its investigations will be produced in due course. During the inquiry into cereals, flour and bread the Committee held 16 meetings and heard evidence from 40 witnesses, representative of farmers, corn-merchants, millers, bakers and consumers throughout Great Britain.

The report contains a systematic account of the marketing and distribution of home-produced wheat, barley, and oats, the milling and distribution of flour, and the cost of baking and distribution of bread. The expenses and profits of millers and bakers were investigated, and their reasonableness or otherwise is fully discussed.

The section of the report which will probably interest farmers most is that dealing with the successful efforts recently made to breed a wheat with the high yield of the typical English varieties, which would in addition command the prices paid for Canadian and some other imported wheats. Such a variety is now available to farmers in "Yeoman."

The Committee concludes by stating, "We have investigated the system of distributing cereal crops and found it to be, on the whole both simple and inexpensive. So far as the manufacture and sale of bread is concerned, we have shown that the time has come for many bakers to reduce their prices consequent on recent reductions in costs, notably in the price of flour."

"We have emphasised that, as the farmer cannot look for any immediate and material improvement in the price he obtains

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\* The report can be obtained through any bookseller or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. (Price 3s. net.)

for his wheat by alterations and economies in the established methods of production and distribution of either flour or bread, a steady and permanent improvement in prices is to be sought by enhancing the intrinsic commercial value of the wheat he grows. This he can do by concentrating on the production of newly evolved varieties of wheat of high milling quality. Indeed, up to the limits of available supply, there is even now no reason why consumers should not be supplied with a high-class all-English loaf if farmers will grow suitable wheats, if millers will manufacture the flour, if bakers will use it, and if all three combine to make the merits of this all-British product known to the public. The creation of an articulate demand is essential. The natural play of economic forces will determine the course events will take, but if for wheat of high-milling quality the farmer ultimately obtains the higher price to which he is or will be fully entitled, while, at the same time the improved varieties yield satisfactorily, wheat production in this country would receive much-needed encouragement."

\* \* \* \* \*

FARMERS in certain districts are uncomfortably aware of what is involved locally by an outbreak of foot-and-mouth disease,

**Distribution of  
Foot-and-Mouth  
Disease.**

and all concerned would be highly gratified if the chief means of its distribution could be discovered. It is a simple matter perhaps to show that many neighbouring outbreaks have been due to contact in markets, or to the distribution of affected animals from a big market. It is quite another matter to determine the origin of many an initial outbreak which may have occurred on an isolated farm on which movement of stock has not taken place. For this reason the article by Sir Stewart Stockman and Miss Marjory Garnett at p. 681 is of special interest.

For some years past the Ministry's Chief Veterinary Officer has had under examination the possibility of the distribution of the virus of foot-and-mouth disease by birds, which it was considered might introduce the disease when migrating from other countries in which it is very prevalent. The authors have investigated the possible relationship between bird migration lines and the outbreaks of foot-and-mouth disease over the past twenty years, and they now detail their results. The problem was approached with an open mind, but the authors did not find it possible to establish a negative; while some factors are uncertain it seems that there are very clear relations, both as



regards seasons and localities, between bird movements and initial outbreaks of foot-and-mouth disease.

It may be added that Sir Stewart Stockman is now carrying the investigation further, by seeking to determine by experimental evidence whether birds do actually convey the virus.

\* \* \* \* \*

THE article by Mr. J. W. Hurst in this issue (p. 715) draws attention to the opportunity which undoubtedly exists for British

**The Farmer's  
Poultry.**

farmers to develop with profit a subsidiary branch of their operations. Before the War about 50 per cent. of the eggs imported into this country were produced in Russia. Practically none of these eggs were the product of specialised egg farms, but originated on the small holdings of the Russian peasantry. Even the large supplies which were imported from Denmark and Ireland before the War, and which still arrive in approximately the same quantities, are produced on general farms. In fact, in every poultry-producing country it may be said that by far the greater bulk of the poultry and eggs produced are the result of the poultry husbandry of the general farmer.

The United States of America, which supplies all the requirements in poultry produce of its population of 110 millions, maintains more than half its total poultry—amounting in all to over 370 million birds—on general farms in the corn belt, and increasing interest in poultry and egg production is being shown by the farmers in these districts. That is not to say that the general farmer in America is devoting more attention to poultry keeping from mere love of the work. On the contrary it is proverbial that in the past the general farmer has disliked poultry and has looked upon them with contempt. Sheer necessity, however, has driven him into active endeavour to take advantage of the opportunity for making the profits offered by keeping poultry on his farm. This is to some extent true of the English farmer.

The present opportunity offers a much wider scope for the development of poultry keeping in this country; but the opportunity is not likely to continue indefinitely. Farmers in countries all over the world are increasing their output of eggs and poultry, and their marketing organisations are in nearly every case endeavouring to secure a footing in the British market, which is the greatest importing market in the world for eggs and poultry. Competition from abroad is therefore likely to become keener; but the man in possession of a market

always has an advantage over a newcomer, and if the English farmer produces and markets in proper condition, a first-grade English egg—which no foreign country can supply—he will not only obtain a benefit for himself in these days of agricultural depression, but will confer a benefit on the nation by reducing the sums paid abroad for imported food.

\* \* \* \* \*

A GOVERNMENT Pavilion is being erected at the British Empire Exhibition at Wembley in which will be shown various Government activities of interest to the Empire. Agriculture will be included, and exhibits are being prepared by various Research Institutes throughout the country in co-operation with the Ministry and the Board of Agriculture for Scotland. The object will be to show, in an attractive and popular manner, the practical application of research to agriculture, and the display should be of the greatest value and interest to agriculturists.

It is proposed also to show various phases of agricultural activities on the cinematograph, and it is hoped to arrange for a series of lectures by eminent authorities. The research exhibit will be explained by guide lecturers. In addition to this review of the assistance given by the Government to agriculture, in the Government Pavilion, a model working dairy is being erected by the National Milk Publicity Council which will be equipped with all the latest improvements in modern dairy appliances.

\* \* \* \* \*

IN the October issue of this *Journal* was published the Ministry's Report for the year ending 31st March, 1923, on the schemes for the improvement of live stock and light horse breeding. The report shows that a good deal has been accomplished in this direction within the limited scope allowed by the economic stricture of the period.

### **The Improvement of Live Stock.**

It cannot be too often stated, or too fully realised how important a part breeding of live stock must play in the revival of the agricultural industry of the country. It has been for many years the proud boast of the British breeder that his pedigree live stock had a world-wide reputation for its excellence, and before the War there was a wide demand from the overseas dominions and foreign countries for animals from the pedigree herds, flocks and studs of this country. This trade



was seriously damaged by the War and subsequent developments, and now that it is reviving with the general demand for fresh stock, every effort is required to maintain and enhance the pre-eminence of British live stock in the world market.

The importance of good breeding too in its relation to the food supply and to the military requirements of the country has been emphasised by the events of the last decade, and these considerations should make the progress shown in the Ministry's report on its improvement schemes of special interest.

\* \* \* \* \*

THE Treasury has appointed a Committee to consider the various methods of levying a Customs Duty upon imported malting barley, and to report what, in their opinion, is the most convenient form of duty. The Committee is constituted as follows:—

**Customs Duty  
on Imported  
Malting Barley.**

Captain M. Falcon, M.P. (Chairman).

Mr. George Bull, C.B.E., representing the National Association of Corn and Agricultural Merchants.

Mr. H. D. Cherry-Downes, representing the Maltsters' Association of Great Britain.

Mr. H. Fountain, C.B., representing the Board of Trade.

Mr. Harry German }  
Mr. Cleveland Fyfe } representing the National Farmers' Union.

Mr. J. Holman, representing the National Federation of Corn Trade Associations.

Mr. W. H. Pascoe, representing the Customs and Excise Department.

Mr. Hugh F. Paul.

Mr. W. H. Ross, representing the Whisky Association.

Major E. A. Ruggles-Brise, M.P.

Mr. R. J. Thompson, C.B., O.B.E., representing the Ministry of Agriculture and Fisheries.

Mr. S. R. Wells, M.P., representing the Brewers' Society.

Sir David Wilson, Bart.

Mr. E. S. Bertenshaw, of the Customs and Excise Department, and Mr. R. Ross, of the Ministry of Agriculture and Fisheries, will act as Joint Secretaries to the Committee.

\* \* \* \* \*

IN the October issue of the *Journal* attention was drawn to the National Rat Week which has been fixed this year for the period 5th to 10th November. This is an

**National  
Rat Week.**

opportune time for farmers and others to make war on rats and mice with the greatest possible chance of success, and eventually to take collective action as enjoined by the Rats and Mice (Destruction) Act, 1919. Application for advice should be made to the local

authority responsible for the administration of the Act, or to the Ministry of Agriculture and Fisheries. In those areas where systematic destruction has been instituted, a great reduction in the number of these pests has taken place. Rats and mice serve no useful purpose in the economy of the farm, but only consume and destroy large quantities of food stuffs. Their eradication is a direct boon to the occupiers of premises in which they have taken up their abode.

\* \* \* \* \*

A FURTHER rise was recorded in September in the average prices of agricultural produce, the general index number

**The Agricultural  
Index Number.**

advancing from 54 per cent. above pre-war in August to 56 per cent. above in September. There has thus been a rise of 5 points from the minimum of June, and although the prices of different commodities vary appreciably, the general level is now practically the same as a year ago. The increase in September was due in the main to fruit and barley, the index figure for the former advancing sharply owing to the very high prices of plums and pears as a result of the poor crops. Small fruits which were on the market last month were relatively much cheaper than plums and pears.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ...	200	183	75	68
February ...	195	167	79	63
March ...	189	150	77	59
April ...	202	149	70	54
May ...	180	119	71	54
June ...	175	112	68	51
July ...	186	112	72	53
August ...	193	131	67	54
September ...	202	116	57	56
October ...	194	86	59	—
November ...	193	79	62	—
December ...	184	76	59	—

The average price of wheat during September was only 19 per cent. above pre-war, compared with 23 per cent. above in September, 1922, and there was a sharp decline as compared with August, 1923, during the early weeks of which most of the wheat on the market was of last year's crop. With more barley of malting quality on sale, prices showed a sharp rise on the month, and at 30 per cent. above 1911-13, were higher than a year ago. Oats declined by about 4d. per cwt., but as this



reduction was relatively the same as in pre-war days, the index number remains unchanged at 30 per cent. above 1911-13. The prices of grain continue at a lower level than those of other kinds of agricultural produce, though hay at only 32 per cent. above pre-war is relatively little dearer than barley or oats. Hay prices showed very little change on the month, but usually these harden in September, so that the index figure declined by 2 points.

The average price of main crop potatoes during September was 75 per cent. above pre-war, whereas in September last year they were down to the pre-war level. There was, however, a pronounced decline during the latter half of the month owing to the markets being over-supplied, and in the week ending 26th September potatoes averaged about 60 per cent. above 1911-13.

Fat cattle were 2d. per stone cheaper than in August, but as prices have declined during the last two months at relatively the same rate as before the war, the index number has remained practically unchanged since July. The prices of fat sheep have been very steady since mid-August, but over the whole of September averaged  $\frac{1}{4}$ d. per lb. less than in the previous month. The index number declined from 76 to 72 per cent. above pre-war, but fat sheep are still relatively much dearer than fat cattle or pigs. The rise in the prices of fat pigs which took place during August has not continued, though there has been no falling away, so that the average for September is about 4d. per stone higher than for August, and the index number shows a rise of 3 points to 55 per cent. above September, 1911-13.

Dairy cows usually advance in value in the late summer and autumn, but the increase of about 15s. per head in September was relatively rather greater than usual. Although there was some improvement in the demand for store cattle towards the end of the month trade was slack on the whole, and the index number shows a slight decline. Store sheep have, however, continued in good demand, and the increase of 2s. per head on the month brings this class of stock to more than double the pre-war level. Store pigs show a further decline and average 95 per cent. above 1911-13, as compared with 102 per cent. above in August. All classes of live stock except store sheep are cheaper than in September, 1922.

The prices received by farmers for milk remained unchanged in September at 67 per cent. above 1911-13, but the rise in the price of butter as compared with August was rather sharper

than usual at this season, and the index number moved from 48 to 56 per cent. above pre-war. Cheese also became dearer and rose to 74 per cent. above 1911-13. Cheese was 24s. per cwt. dearer than in September, 1922, whilst butter was 2 $\frac{3}{4}$ d. per lb. cheaper.

As is usual at this time of the year eggs showed an appreciable rise, being nearly 3d. per dozen dearer than in August, the index number increasing from 68 to 75 per cent. above pre-war.

\* \* \* \* \*

THE Cumberland and Westmorland Committee have extended their current agreement to cover the hiring period 11th November, 1923, to 7th June, 1924. The terms are as follows:—

**Conciliation  
Committees  
in Agriculture.**

n Agriculture.	Skilled male workers aged 21 and over	...	...	...	37/-	} For a week of customary hours (defined as 63).
	Skilled male workers aged 20 and under 21	...	...	...	32/-	
	Skilled male workers aged 18 to 20	...	...	...	28/-	
	Skilled male workers aged 16 to 18	...	...	...	23/-	
	Other adult male workers 30/- for a week of 54 hours in summer and 48 in winter.					

Female workers aged 16 and over, 5d. per hour.

Provision is also made for overtime to be paid for at the rate of 8d. per hour and for the value of board and lodging to be computed at 15s. per week for all male workers of 16 years of age and over.

The agreement of the Devonshire Committee, which was due to expire at the end of September, has been extended to 5th January, 1924, with the understanding that unless either side asks for re-consideration it will continue to Lady-day. The terms provide for the payment to adult male workers at the rate of 30s. for a week of 51 hours, with overtime at 8d. per hour on weekdays and 10d. per hour on Sundays. Rates of wages for male workers under 21 years of age and the values at which the provision of board and lodging may be reckoned are also included in the agreement.

The Merioneth and Montgomery Committee have also decided to maintain wages at the present level, the current agreement having been extended to 30th April, 1924. The rates are 31s. for a guaranteed week of 60 hours for stockmen (the guaranteed weekly wage for these workers being a new feature of the agreement), 28s. for a week of 52 hours for other adult male workers and proportionate rates for male workers under 21 years of age.

\* \* \* \* \*



## BIRD MIGRATION AND THE INTRODUCTION OF FOOT-AND-MOUTH DISEASE.

SIR S. STOCKMAN,

*Chief Veterinary Officer, Ministry of Agriculture and Fisheries,*  
and

MISS MARJORY GARNETT.

IN an article entitled "The Question of Invasion" prepared by the senior author (S. S.) for his Annual Report in 1919\* he discussed the problem of invasion of this country by foot-and-mouth disease in the light of what seemed to emerge from studying the outbreaks over a period of 20 years. Since then further outbreaks have been considered (1919-1921) but, although these necessarily increase the number examined, the alteration in the incidence of locality is negligible, and no entirely new facts of importance have come to light. By examining the recorded stories of outbreaks, it was found possible to classify them under two important heads:—(a) Initial outbreaks of invasion; (b) Outbreaks of ramification from the former.

Those in (b) require no further explanation for their classification.

As regards those placed in (a), they are those which arose after the country had been free from the disease for more or less long periods—months or years—in excess of what there is reason to believe represents the usual viability of the virus outside the body, and those arising simultaneously in parts of the country very remote from each other and having no possible connection, except perhaps through the same agency, whatever it be, whereby the virus is carried long distances and in certain directions. This apparently is the same problem as that of invasion from without the country. In this particular connection it has to be noted:—

(1) That the entry into Great Britain of ruminants and swine was totally forbidden, as was also the importation of straw and hay from any infected country; yet the outbreaks of invasion continued.

(2) That the outbreaks were dealt with by slaughter, and the question of recovered carriers of infection did not therefore arise.

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\* *Annual Report of Proceedings under the Diseases of Animals Acts, Ministry of Agriculture*; see also *Journal of Comparative Pathology and Therapeutics*, Vol. XXXIII, 1920.

(3) That all infected premises, after slaughter of the animals, were disinfected both chemically and by prolonged isolation as regards fresh stock entering thereon, and were never attacked more than once.

**Possible Carriers of Infection.**—Feeding stuffs and packing materials imported from abroad, and human beings who had come from foreign countries, fell under suspicion as the mechanical carriers of infection in general, for the evidence is definite in connection with the outbreaks of ramification that infection can be carried by human beings, by food stuffs, and by straw. Although on inquiry it very occasionally transpired that one or other of these possible agencies might have been the origin of an initial outbreak, in the vast majority of cases there was no such evidence, and in many cases the initial outbreaks arose on more or less isolated farms, where nothing but home-grown material had been used; at which no strangers had visited; and off which the residents and attendants had not been for some considerable time before the outbreak. Additional and strong evidence against imported materials of commerce or human beings from abroad being generally responsible for the introduction of infection was brought out from the fact that the distribution of the initial outbreaks did not follow the lines of distribution of the imported food stuffs, etc. Human beings, and imported food stuffs, go to all parts of the country, but it transpired, in fact, that the greater part of the United Kingdom had escaped outbreaks of initial invasion, and that these, over a period of 22 years, had arisen almost entirely in more or less definite areas, some of these, again, being much more favoured than the others. The same premises in these areas, moreover, were practically never stricken a second time, a fact which finally demolished the improbable suggestion that infection might have lain latent from a previous outbreak. The distribution of these initial outbreaks of invasion was sufficiently definite to justify the conclusion that it did not arise from purely fortuitous circumstances. As is well known, the invasions of this country occur during the waves of prevalence of foot-and-mouth disease on the Continent of Europe.

Human beings, imported animals, and food stuffs—the ordinary communication between farm stock and the outer world, as it were—having been eliminated as agencies of conveyance in general, it seemed worth while examining the possibility of the virus being air-borne, particularly through the agency of birds. It is worthy of mention here that



publication of the article previously referred to (Annual Report, 1919) has aroused special interest amongst the inspectorate staff of the Ministry of Agriculture dealing with outbreaks in the field, and some of them in their reports have been able to furnish actual and personal observations, which tend to show that in connection with outbreaks of ramification, at least—outbreaks arising, say, up to a few miles apart from each other—birds are responsible for carrying infection. The reports also contain the information that at the time of certain initial outbreaks flocks of birds (place of origin unknown) had been observed in the neighbourhood, and even on the farm where infection arose.

In outbreaks of ramification birds (chiefly starlings, rooks, crows, wood pigeons and gulls) have been seen to feed at the troughs used by affected animals at pasture, and to fly to other farms nearby, where disease subsequently broke out, notwithstanding there had been no other known communication between the premises.

In considering the way in which birds might carry infection, three possibilities suggested themselves:—

(1) The birds might contract an attack of the disease in some form. Birds in general are known to be very insusceptible to the disease, but there are recorded cases which seem to show that this species-insusceptibility is not absolute. Therefore, given only a few susceptible birds affected with the disease, amongst the millions which migrate to this country, this explanation would not outrage the observations as to incidence.

(2) That by frequenting infected pastures, etc., the birds might contaminate their feet or plumage with the virus, and afterwards carry it over long distances to other pastures, etc. This is definitely possible, since we know that the virus, so long as it can find the conditions for maintaining its viability, can be carried on straw, hay, clothes, etc., and feathers might warrantably be included.

(3) That the virus might be swallowed (in food or water) by birds, pass through their intestines uninjured, and afterwards be excreted in their droppings at places remote from where the virus was picked up.

The object of this article is to deal with the circumstantial evidence, without, for the moment, dipping into the experimental evidence, such as it is at present. It is a remarkable fact, however, that initial outbreaks of invasion practically

never arise amongst animals which are completely housed, and the ramifications from initial outbreaks are infinitely more numerous if invasion occurs at seasons when most of the animals are at pasture. The spread of the disease from premises to premises, moreover, can be checked to a remarkable extent if owners can be prevailed upon to keep their animals indoors, which may, of course, at times be impossible, for obvious reasons.

A map of the initial outbreaks—80 in number—over a period of 22 years, was filled in (*see* Map 1, which is a summary, as it were, of the principal map). A chart was also constructed showing the monthly incidence of the initial outbreaks in each year of the 22; the totals are summarised in Table I.

It is upon the above records and circumstances that the junior author\* has brought to bear her studies on birds and their movements, a subject which has occupied her attention for many years. To prevent misunderstanding, however, it should be explained that, both the authors being aware that a positive was practically impossible to prove under the circumstances, the object of the inquiry in the first instance was to see whether the question could not be definitely settled by proving a negative, that is to say, by finding the circumstances of invasion so out of accord with those of bird movements that the theory could not be entertained. This it is hoped will relieve the authors of any imputation of a desire to engage in special pleading.

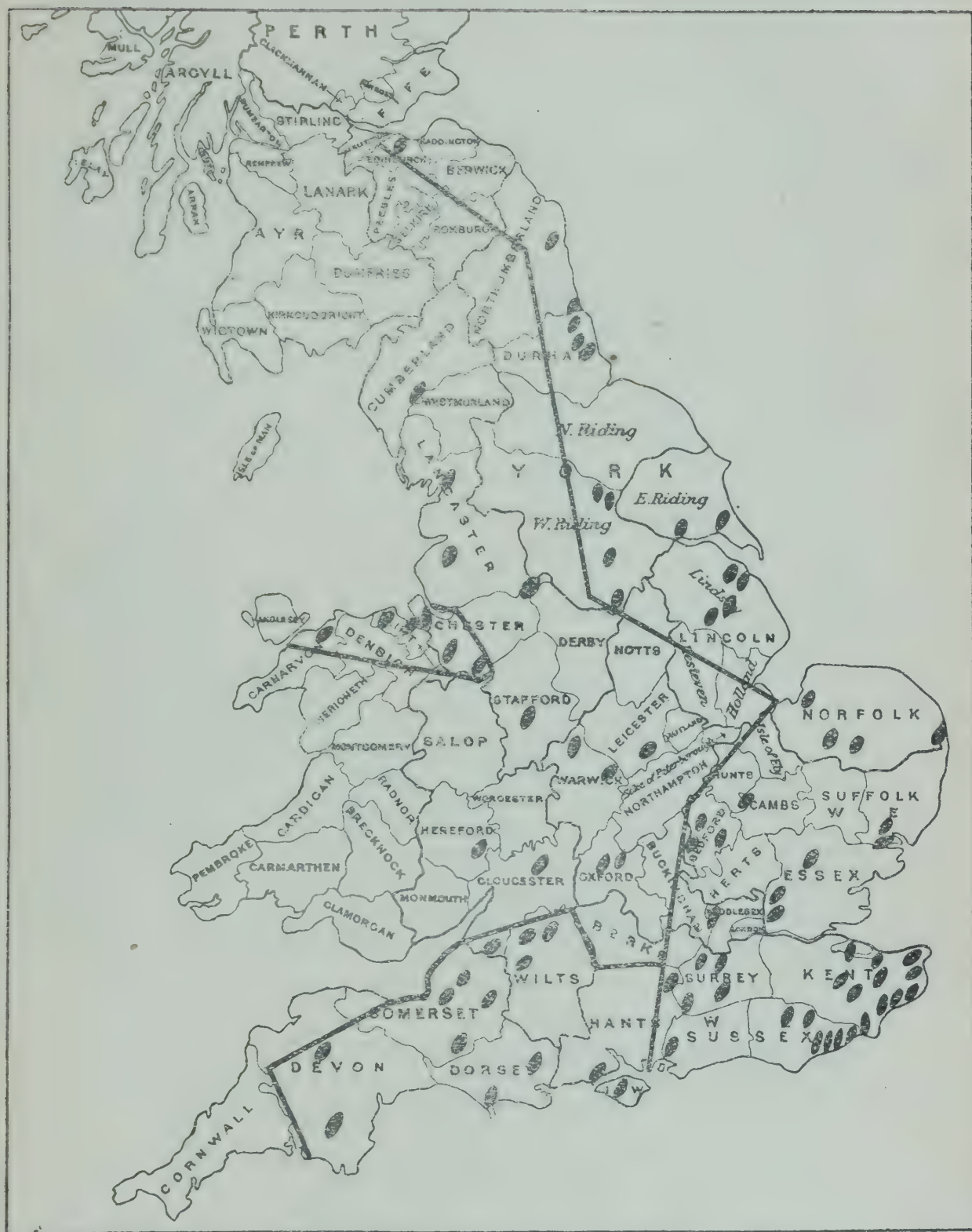
**Bird Migrations.**—A closer examination is made in this paper of the initial outbreaks of foot-and-mouth disease for the last 22 years in connection with bird migration, and particularly the migrations of those birds which frequent pastureland, as these are the most likely to carry the virus of the disease, if it can be so carried.

Foot-and-mouth disease occurs very little in the countries north of Denmark, and if birds bring it to England from the Continent, they must come from countries to the east, south-east and south. One would expect therefore, to find most of the outbreaks in the south-east part of England. This is actually so; for if a line is drawn from the Wash to the Bristol Channel, it will be found that in the district north and west there have been 27 initial outbreaks, and in the district south

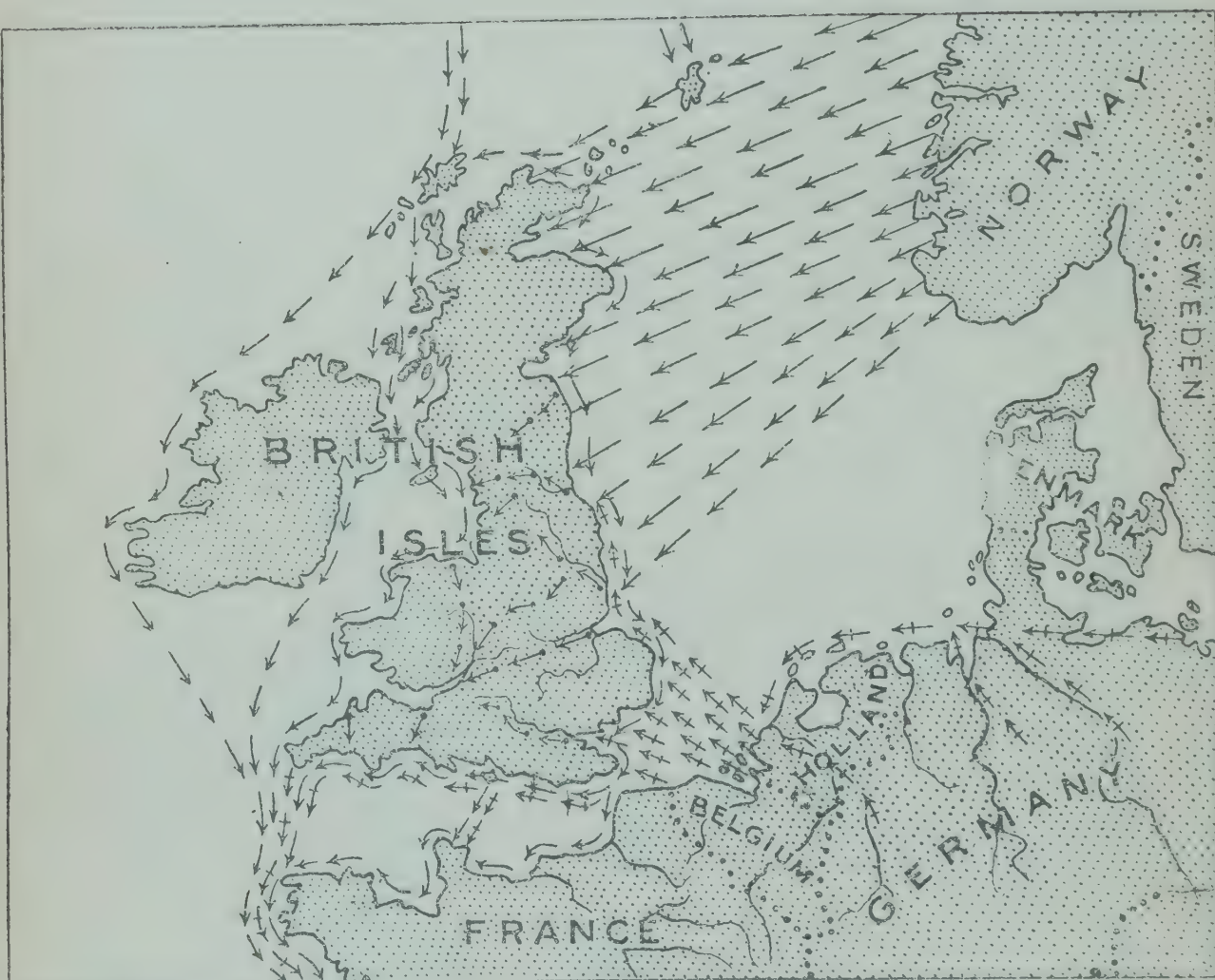
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\* Miss Garnett is almost entirely responsible for the work relating to bird movements in particular.





MAP 1.—Showing Initial Outbreaks of Foot-and-Mouth Disease during 22 years (1900-1921).



— KEY —

- East & West Route ..... ↔
- Migrants from Scandinavia, Iceland,  
Greenland & Northern Europe ..... →
- Chief Overland Routes in England ... →

MAP 2.—Diagrammatic Map of Bird Migration Routes (Autumn).



and east 52, or nearly twice as many. Of these 52, 36 have occurred east of a line drawn north and south through the Isle of Wight.

There are two great tides of bird migration which flow through these islands; (a) the well-known movement roughly from north and north-east to south in autumn and back in spring, and (b) the less known, but not less important movement from east to west in autumn and west to east in spring.

In the autumn migration on the "north and south route" great numbers of birds arrive on our north-east coast from Scandinavia to continue their journey southwards, and birds from Iceland, Greenland, and northern Europe, pass down both the east and west coasts. This migration need not be taken into account, because the birds following these lines do not come from countries frequently infected.

There remain, then, two regular annual migrations of birds from the south and east:—

(1) The spring migration from the south of birds returning to summer quarters in the British Isles, or passing through on their way further north. This movement begins about mid-February and lasts through March, April, May and sometimes even into June.

(2) The "east to west" autumn migration, when immense numbers of birds arrive on our east and south-east coasts after crossing the North Sea from the shores of Belgium and Holland. This migration starts in mid-September, and lasts throughout October and the first half of November. It may, however, start again any time during the winter when there is severe weather on the Continent of Europe.

The following Table shows the total number of initial outbreaks of foot-and-mouth disease for each month of the year over the whole period 1900-1921, and also the number of years during the same period in which outbreaks have occurred in each month.

TABLE I.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Number of Outbreaks..	14	5	4	4	2	2	9	3	8	8	8	12
Number of years in which outbreaks have occurred	4	4	4	4	1 or 2*	2	5	3	6	5	6	6

\* 1 doubtful case.

The second set of figures shows pretty clearly in which months the outbreaks are of most *regular* occurrence, and serves as a useful check on the first set, though the first set

would be influenced more or less by the opportunities for infection of a large or small number of birds.

From this Table it is clear that by far the greater number (rather more than 64 per cent.) of initial outbreaks have occurred in the months from September to January; that is in the months when birds are coming to England by the "east to west" route, either on normal migration, or (in December and January) owing to hard weather on the Continent. The incidence is also annually high in these months.

From February to May, the months of the spring migration, there are far fewer initial outbreaks, and they are of less regular occurrence than in autumn and winter.

The three summer months, June, July and August, are of peculiar interest because of the large number of outbreaks in July. Migration during the summer is not altogether at a standstill; belated spring migrants are still passing north in June, and in July and August there is probably a little east to west migration. Until, however, more is known definitely of the movements of birds at this season, it is difficult to say whether they can account satisfactorily for the *number and regularity of these outbreaks* in July, and the incidence in this month must for the present be accepted as unfavourable to the theory of birds as carriers of infection over long distances.

So far as can be seen from a contour map, however, the localities of the outbreaks of foot-and-mouth disease favour, on the whole, the idea that the virus may have been introduced by birds. The majority are not exactly on the coast; but migrants, on arrival, unless very exhausted, usually fly inland for some distance before alighting; and many of the more inland outbreaks are in river valleys, which are always great highways for birds. Even when there is an isolated outbreak well into the country (like that near Ripon on 16th July, 1910) there is always the possibility that just before and after that date the bird or birds did not alight in any place where they could have come in contact with cattle, etc., or that cattle did not pick up the virus although deposited.

A striking feature about the outbreaks on the coast is that, unlike those more inland, most of them are near towns of some size. For instance, out of 10 outbreaks on the coast in Kent, 2 are near Rye, 2 near Folkestone, 1 near Hastings, 1 near Deal and 1 near Margate. There is probably some reason for this, and so far as birds are concerned, the most likely explanation is that these outbreaks have been caused



by gulls, which are attracted to places where fishing goes on by the offal that is thrown out.

**Species of Birds likely to be Carriers.**—Before going into more detail with regard to the individual outbreaks, it will be useful to review briefly the birds which, from their habits, would be most likely to carry and spread the disease. These must be mainly birds which (a) frequent pasture fields, and (b) are migrants, coming to this country from places to the east and south (infected countries), especially birds using the "east and west" route in autumn and winter.

Immense numbers of **ROOKS** (*Corvus frugilegus*), **JACKDAWS** (*Colœus monedula*), **STARLINGS** (*Sturnus vulgaris*) and **SKYLARKS** (*Alauda arvensis*) come in from central Europe in autumn, travelling from east to west across northern Continental Europe, and down the river valleys to the coasts of Belgium and Holland, whence they cross the North Sea to our east and south-east coasts. In spring, birds of the same species which have wintered in southern Europe, arrive on the south coast, and also on the east coast between Kent and Norfolk. All these birds frequent pastureland. Starlings in particular delight in feeding close to animals at pasture. They are also attracted to feeding troughs in winter.

**WAGTAILS**, particularly **PIED WAGTAILS** (*Motacilla alba lugubris*), are also fond of feeding near animals at pasture, probably to pick up the insects they disturb in the grass. These birds do not use the east and west route, but **Yellow** (*Motacilla flava*), **White** (*Motacilla alba alba*) and some **Pied Wagtails** come in from the south in spring.

There are a few records of **HERONS** arriving on the east coast in September, and they are birds which sometimes frequent marshy pastures and those bordering rivers and ponds.

**GEESE** come in autumn from the far north (which is not infected), but some which have wintered on the Continent pass through in spring on their return journey north, and both geese and ducks come in great numbers to the east coast in hard winters, when the marshes of the Baltic and the Holland coast are frozen. The grey geese feed regularly in the fields and marshes at night, but usually near enough to the sea or to some estuary to return there to rest during the day.

Of **DUCKS** the **Mallard** (*Anas platyrhynchos*) (Wild Duck) and **Teal** (*Anas crecca*) are perhaps the most likely to come in contact with cattle. Most of the mallard wintering in this country come from the north in autumn, but in hard winters

many come from the east and south-east also. At that time of year they often spend the day in large flocks on the sea, or on mud flats, or sheets of open water, flying in at night to feed in the marshes and fields.

Some of our teal (as well as some mallard) winter on the Continent, and might bring the disease back with them in spring. They would only be likely to affect cattle in marshy fields or near drinking pools. Several initial outbreaks have arisen on such pastures.

A great many WOODPIGEONS (*Columba palumbus*) come to this country by the east and west route. They do not regularly feed in pasture lands, but may visit the feeding troughs.

There are three common WADERS which frequent pasture fields in large flocks. The Lapwing (*Vanellus vanellus*) (Peewit or Green Plover) and the Golden Plover (*Charadrius apricarius*) are found both inland and on the coast, the former being extremely common and the latter fairly well distributed in winter. Immense numbers of lapwings, as well as a few golden plovers, come here by the "east to west" route in autumn and winter. These birds might also bring the disease when migrating north in spring.

The third wader, the Curlew (*Numenius arquata*), is much more of a shore bird in winter than the other two, especially in cold weather, though many resort to inland pastures to feed or to rest at high tide. Some curlews come in by the "east to west" route, and birds wintering further south pass through England in spring, when they go inland to their nesting places, and they also follow some of the overland migration routes on their way further north.

The Redshank (*Tringa totanus*) and Common Snipe (*Capella gallinago*) ought perhaps to be included in the list of waders: both, though present in England all the year round, are migratory to some extent, and both are fond of marshy pastures.

There are other waders, some of them typical shore birds, which might bring the disease when migrating overland or along our coasts, especially when they return northwards in spring and early summer; but none are of great importance in the present connection, though it is possible that even rare visitors (or vagrants) might cause isolated cases.

GULLS are especially interesting because of the large numbers of immature and non-breeding birds which have nothing to prevent them from wandering about at all seasons. Of the five common kinds, four—the Greater Black-backed Gull (*Larus*



*marinus*), Lesser Black-backed Gull (*L. fuscus*), Herring Gull (*L. argentatus*), and Common Gull (*L. canus*)—take from three to five years to become adult, and the Black-headed Gull (*L. ridibundus*) does not usually breed until two years old. These gulls vary individually in numbers at different places and different seasons, and except the great black-backed, are by no means confined to the coast. The two smaller kinds (black-headed gull and common gull) feed to a large extent on earth-worms and grubs, following the plough or getting them from pasture fields. All gulls are, however, omnivorous, fishing when inland in rivers and ponds and feeding on garbage heaps. Several initial outbreaks have arisen near garbage heaps from slaughterhouses and fish factories. Gulls often rest in pasture fields even when not feeding there.

Not much is known definitely about the migrations of gulls. There is a general movement south in autumn, and north in spring. During the herring season on the Norfolk coast (*i.e.* in autumn), large numbers of great black-backed gulls and herring gulls congregate there, and it is almost certain that some immigration of gulls takes place at that time from the coasts of Holland and Belgium.

Besides these regular migrations, gulls are often on the move; when going from place to place they prefer to fly against the wind, and it is impossible to say how far they may go in search of food. The summer wanderings of immature and non-breeding birds might possibly account for some of the July outbreaks, which occur when there is practically no regular migration.

A closer analysis of the migratory movements of birds in relation to the seasonal and local incidence of the outbreaks of invasion (initial) is attempted in the following paragraphs.

**Spring Migration** (*see* Map 3, February, March, April and May).—Birds returning in spring to the British Isles to breed, or on their way further north, either cross the Channel direct to the south coast, and make their way north by inland routes, or follow up the east and west coasts. Many of them pass inland up the river valleys on their way to their nesting places. Those which have come up the west coast of Europe and are bound for Scandinavia and northern Europe, may cross the Channel via the Scilly Isles and then continue north-eastwards along the south coast of England, or turn northwards up the west coast for some distance before crossing over to the east by

one or other of the overland routes. The general tendency at this season is from west to east over England as well as from south to north.

This migration does not start till mid-February (W. Eagle Clarke gives 11th February as the earliest date for arrivals on the south coast). The February outbreaks are all early in the month. This, however, would not necessarily exclude birds as carriers since earlier movements might take place at the tail-end of winter, and as weather movements. Nevertheless, it would be very curious if the weather migrants carried the disease in early February and the regular migrants did not do so later in the month, but neither spring immigration nor spring invasions are to be regarded as confined to February: the incidence is high in March and April, only falling in May and June.

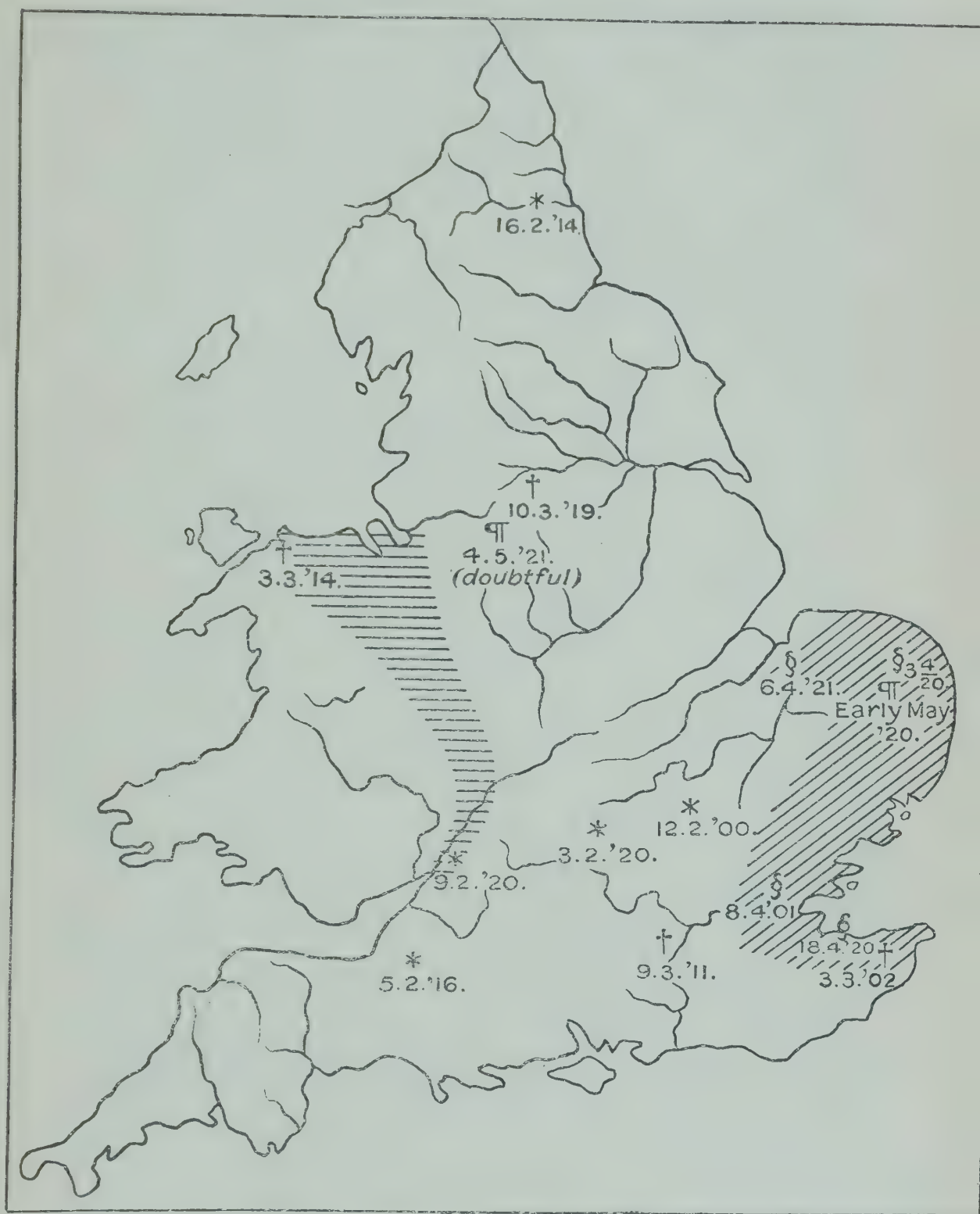
It must be borne in mind that all the dates here mentioned, and those on the maps, are the dates of the actual appearance of the disease, and that from 5 to 10 days or more must be allowed for the virus to be picked up and for the period of incubation in the animal. This might easily take early February outbreaks back to January and winter movements, and so on for other dates.

South of the Wash there are March outbreaks in Kent and Surrey, April ones in Kent, Essex and Norfolk, and one May outbreak in Norfolk. These might be accounted for by the south to north migration of birds which have come directly across the Channel to the south coast; or the outbreaks in Kent, Essex and Surrey might equally have been caused by birds which had entered the country by way of the Thames estuary.

Either way the absence of outbreaks in the west of England and in South Wales is noteworthy, and if it means anything, points to infection having come from south-east rather than from due south. The idea that this may indeed be so receives some support from the fact that, according to W. Eagle Clarke (*Studies in Bird Migration*), "during late February, throughout March, and sometimes the first half of April, considerable numbers of rooks, occasionally accompanied by daws, starlings and skylarks arrive during the day-time on the south-east coast of England between Kent and Norfolk." These birds arrive from the east and south, and must be almost the only birds following the east and west route in *that direction* in spring.

The March outbreak in Yorkshire might have been due to birds which had come up the east coast and followed up the river valleys from the mouth of the Humber.

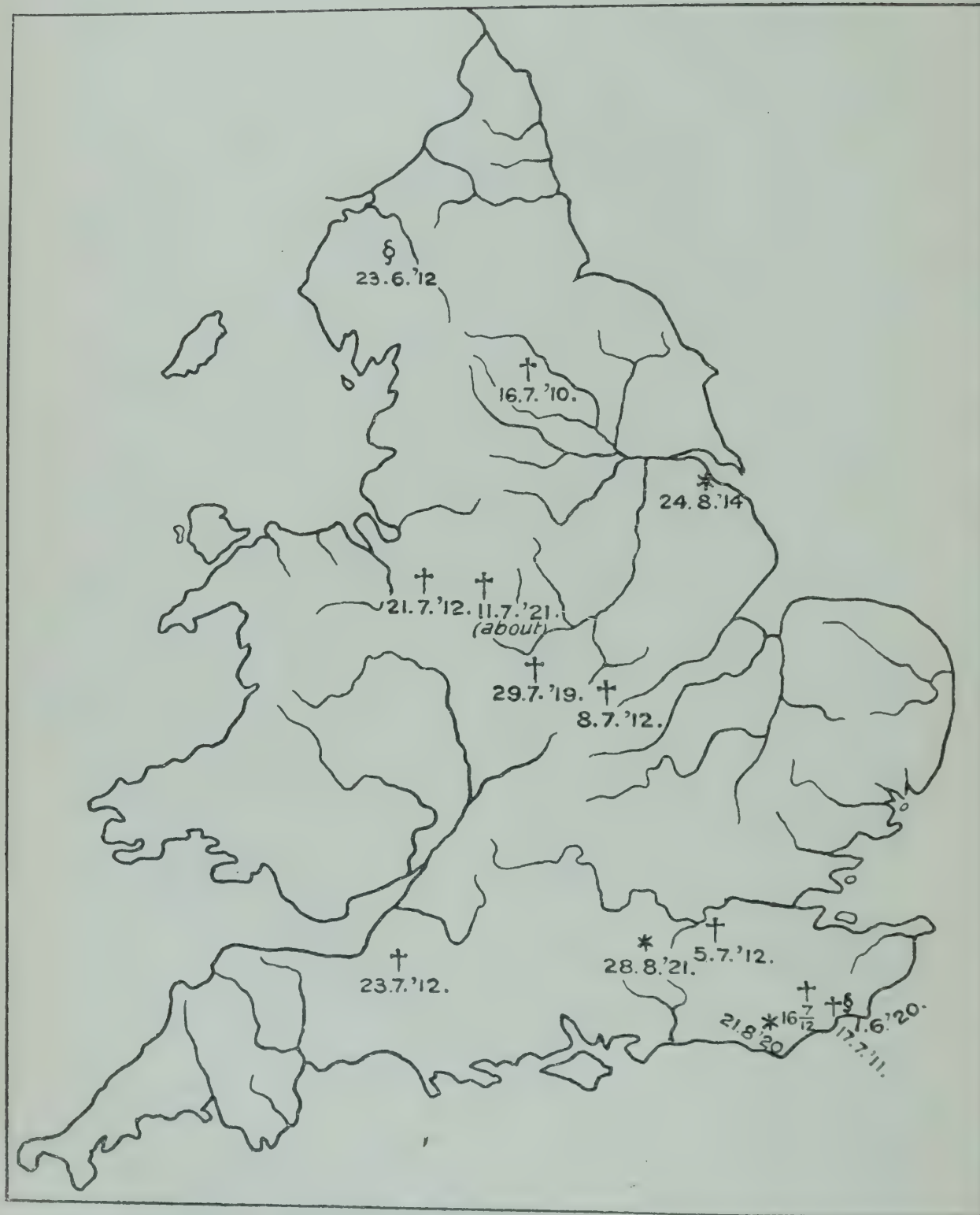




MAP 3.— Distribution of Outbreaks of Foot-and-Mouth Disease in February, March, April and May.

The oblique shading indicates roughly the area most affected by immigration of Rooks, etc., on the East Coast at this season.

The horizontal shading shows the route followed by Gulls from the Severn to North Wales and Lancashire.



MAP 4. -Distribution of Outbreaks of Foot-and-Mouth Disease in June, July and August.



The March outbreak in North Wales would not appear very difficult to account for at first glance on the theory of birds being carriers. There is a well-known migration of gulls in autumn from the Dee estuary across the Ellesmere district of Shropshire and down the Severn valley to the Bristol Channel, and in spring there is a rather less marked return movement north along this route, some of the birds crossing the hills of north-east Wales, which would bring them out in the Rhyl and Conway valleys. This route is followed by black-headed, herring, and lesser black-backed gulls, and except for the first they do not often alight on the way. The March outbreak (Denbigh) would fit in well with this spring movement.\* There have, however, been two other outbreaks along the same coast, neither of them anywhere near the time of the spring migration. These will be referred to later.

**Summer Migration** (Map 4, June, July and August).—In June some birds on passage to the north continue to cross our shores; and in July a few waders certainly arrive, mostly non-breeding birds and those that have finished nesting early. Some of these have probably come to us from the south-east (*e.g.* Ruffs in Kent). Most of the birds of which records are to be found, however, are of the rarer kinds, and as the July outbreaks have been, comparatively speaking, numerous, and have occurred in five different years, which shows them to be almost as regular as the winter ones, fortuitous migrants can hardly be accepted as having introduced the virus in July.

There are a few birds which from their habits are to some extent open to suspicion, though there is little or no positive evidence of their coming from the Continent at this season.

Young starlings, both here and on the Continent, flock together and begin to move about as soon as they are fledged (*i.e.* about the middle of June). From 20th June onwards great numbers migrate from east to west across Heligoland, and there is some evidence that they have once or twice arrived on the east coast of England about the end of the month. It would seem, however, very exceptional for this migration to reach our shores.

Some lapwings are in flocks as early as the middle of June, and the fact that our own breeding birds are moving down to the coast and sometimes visiting outlying islands and lightships

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\* Given outbreaks in England in the northern or southern limits of this track, infection might be conveyed from north to south or vice versa. It is a fact that outbreaks on the Lancashire coast have been followed by others of quite obscure origin on the south-west coast.

in late June and in July, makes it possible that some immigration might take place without attracting notice.

Young herons (*Ardea cinerea*) on the Continent have been known to make very long journeys before the end of June; and while but little is known definitely of their migrations it is certain that there is a little immigration by the east and west route in autumn; as with the lapwings, the arrival of a few in late summer would be difficult to observe, because the home-bred birds frequent the shore at that season.

If birds have carried the virus for these July outbreaks, movement of gulls would also be a possible explanation. There are always a lot of young and some old, non-breeding birds round the coast in summer; they wander inland almost anywhere, following up the river valleys, visiting ponds and reservoirs, and any fields where they can find food. Their numbers might easily be increased by arrivals from the Continent without attracting notice, especially in summer when our own breeding birds are beginning to move about.

The distribution of these outbreaks particularly arouses curiosity; 5 out of 9 in July are north of the Wash to Severn line, while in all the other months the majority of the outbreaks are south of that line.

In most of the cases north of the Wash, it looks as if the disease had been brought up the Humber and dispersed along its tributaries into the surrounding country, or else had been brought in by the Wash and carried across England in a north-westerly direction; this might also apply to the outbreak in Cumberland in June, 1912. The July outbreaks south of the Wash might have been caused by birds which had entered either by the south coast or up the Thames valley.

The outbreaks on the coast in Kent near Rye in July, 1920, and June, 1911, by their position close to a fishing town, at once suggest gulls, possibly from the northern coast of France.

**Autumn Migration** (Map 5, September, October, November).—In autumn, besides the birds which stream down our coasts from the north, and those which cross the North Sea from Scandinavia and arrive on the east coast of Scotland and the north-east coast of England (these come from clean countries), an immense number comes to us from the east and south-east across the southern portion of the North Sea.

The centre of this immigration (from east and south-east) is on the Essex coast and the mouth of the Thames, and it extends from Dungeness in Kent as far north as Lincolnshire. The direction from which the birds come is due east on the



Essex coast and mouth of the Thames, and south-east in Norfolk and Lincolnshire, where, from their line of flight, they are thought to have crossed the North Sea from the estuaries of the Maas, Scheldt and Rhine, down which rivers they have travelled on their way from central Europe.

From the north coast of Norfolk many birds turn south-west and cross England from the Wash towards the Bristol Channel; others continue to "skirt the coast northwards (which they—the skylarks and grey crows in particular—sometimes do as far as the Tees) proceeding inland at various points as they go. Those forming the left wing, and they are a considerable contingent, pass westward along our Channel shores to reach winter quarters in southern and south-western England and in Ireland, while others doubtless cross towards the shores of France en route for more southern lands."\*

The regular autumn migration lasts from September to mid-November, and all the initial foot-and-mouth outbreaks during this time occur in areas which could be affected by the migration. A few of the September outbreaks are rather early for this regular migration, but there is no doubt that some birds arrive in this country from the east as early as August.

The isolated series of outbreaks in Northumberland, Lancashire and North Wales in September, 1912, is interesting, and at the same time puzzling. For one thing they are much further north than any others at that season. Again, there have been three initial outbreaks altogether on the north coast of Wales in 22 years—these constitute the only outbreaks up to date which have arisen on the west coast—and there is a curious coincidence between these and the initial outbreaks in Northumberland, viz. :—

1912.	N. Wales—1st Sept.	Northumberland—9th Sept.	South Lanes.— 1st Sept.
1914.	N. Wales—3rd Mar.	Northumberland—16th Feb.	
1920.	N. Wales—22nd Jan.	Northumberland—18th Jan.	North Lanes.— 20th Jan.

The Lancashire outbreaks in 1912 and 1920 seem partly to link up the two places. Whether there is really any connection, however, is a matter for speculation; there is certainly migration overland between the north-east and north-west coasts which might account for it, but one would not expect to find birds moving north-east in September or south-west in February-March. There is, however, so long an interval between the latter (16th February—3rd March, 1914) series of

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\* W. Eagle Clarke, *Studies in Bird Migration*.

outbreaks that they are less likely at least than the others to be connected.

**Winter Migrations** (Map 6, December, January and February).—After the middle of November the regular autumn migration ceases, but nearly every winter there are spells of hard weather when birds from the Continent are driven to seek refuge in the British Isles, where, especially in the west, the climate is milder.

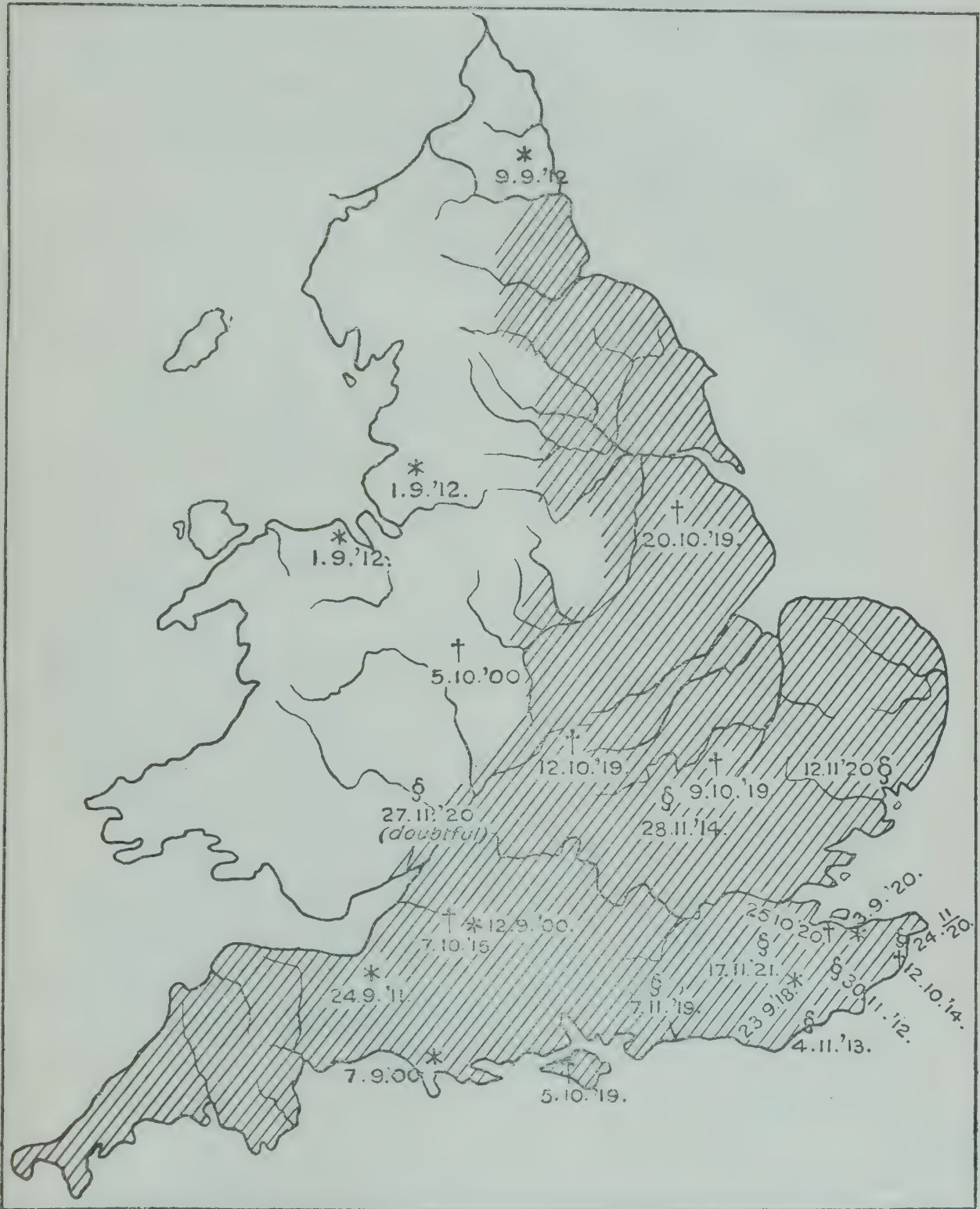
Many of these birds come by the “east and west” route, their migrations sometimes lasting for days if the weather continues severe, and at such times swarms of birds including rooks, larks, lapwings and great numbers of wildfowl arrive on our east and south-east coasts, most of them travelling westward through southern England, or along the south coast, or crossing to Ireland.

These forced migrations in search of food and shelter may occur at any time between November and March, but the chief months are December and January, which are also months when the number of outbreaks of foot-and-mouth disease is high.

Any of the outbreaks south of the Wash, and after the regular autumn migration season, might have been caused by birds on these weather movements, but there have also been 11 north of the Wash where the “east to west” migrations apparently do not extend at this season.

There is a curious movement of gulls, however, on the north-east in winter, when, during strong north or north-east winds between October and January, great numbers of common gulls, herring gulls and lesser black-headed gulls fly along the shore or over the sea, heading north or north-west against the wind. This movement is observed in Yorkshire from Spurn Point to the Cleveland coast, and opinions differ as to whether it is true migration or only due to the gull habit of flying up wind (not nearly so many gulls return south, however, when the wind changes to south-west). Either way it is possible that birds from the Continent may form some part of the movement, especially as north-east winds in winter often coincide with very cold weather. In Yorkshire during the north-east wind the gulls only fly past over the sea, but there seems to be no mention of them passing up the Northumberland coast, and as the movement depends on wind, it must be of uncertain duration, and it would account for the presence of gulls from the





MAP 5.—Distribution of Outbreaks of Foot-and-Mouth Disease in September, October and November.  
The shading indicates roughly the area affected by "East and West" migration at this season.



MAP 6.—Distribution of Outbreaks of Foot-and-Mouth Disease in December, January and February. Shading indicates roughly the area chiefly affected by "East and West" migration at this season.

The arrows on the N.E. Coast show the course of Gull movements during N. and N.E. winds.



south on the north-east coast at that season. Once there they might wander anywhere inland in search of food.

These winter movements do not, of course, occur with the regularity of the autumn and spring migrations, and yet there have been more outbreaks of foot-and-mouth disease in December, January and February than in September, October and November. If, therefore, the disease has been brought by birds in these out periods, some further explanation seems necessary. It might depend, however, upon the habits of birds varying with the seasons, as they do. For instance, some which feed in stubble fields in autumn take to the pastures in winter, and so would be more likely in that season, if infective at the time, to infect animals at pasture.

**Conclusion.**—In conclusion there would appear to be most remarkable relations, both as regards seasons and localities, between the movements of birds and the initial outbreaks of invasion in foot-and-mouth disease in Great Britain. Some of these outbreaks, however, do not correspond with what are believed to be the known facts as regards bird movement. On the other hand, these facts are admittedly incomplete, and the circumstantial evidence as a whole is very far short of being able to establish a negative.

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## IMPERIAL ECONOMIC CONFERENCE, 1923: IMPORTATION OF LIVE STOCK.

At a meeting of the Imperial Economic Conference which was held on 26th October, the question of the Importation of Live Stock was discussed. Those present included:—

The Right Hon. Sir Philip Lloyd Greame, K.B.E., M.C., M.P., President of the Board of Trade. (In the Chair.)

His Grace the Duke of Devonshire, K.G., G.C.M.G., G.C.V.O., Secretary of State for the Colonies.

The Right Hon. L. S. Amery, M.P., First Lord of the Admiralty.

Lieut.-Col. The Hon. Walter Guinness, D.S.O., T.D., M.P., Financial Secretary to the Treasury.

The Right Hon. Sir Robert Sanders, Bart., M.P., Minister of Agriculture and Fisheries.

Lieut.-Col. A. Buckley, D.S.O., M.P., Parliamentary Secretary to the Department of Overseas Trade.

The Right Hon. W. L. Mackenzie King, C.M.G., Prime Minister of Canada.

The Hon. George P. Graham, M.P., LL.D., Minister of Railways and Canals, Canada.

The Right Hon. S. M. Bruce, M.C., Prime Minister of the Commonwealth of Australia.

The Right Hon. W. F. Massey, Prime Minister of New Zealand.

The Hon. Sir James Allen, K.C.B., High Commissioner for New Zealand.

The Hon. H. Burton, K.C., Minister of Finance, Union of South Africa.

Mr. C. A. Innes, C.S.I., C.I.E., Member of the Governor-General's Council for Commerce and Railways, India.

Mr. Dadiba Dalal, C.I.E., High Commissioner for India.

The Hon. W. G. A. Ormsby-Gore, M.P., Parliamentary Under Secretary of State for the Colonies.

The Chairman suggested that the Conference would probably wish the Minister of Agriculture to open the discussion. and Sir Robert Sanders thereupon addressed the Conference.

**Sir Robert Sanders:** I do not want to go at too great length into the history of what has been a somewhat contentious subject. The position was until a year ago that all live cattle



were prevented from coming into these islands and it is under that system that the present generation of agriculturists have carried on their business. That was called the "embargo" and that was imposed by the "Diseases of Animals Act, 1896." I am quite aware that great objection is taken particularly to the name of that Act, an objection which I have heard expressed on several occasions with vehemence, I might almost say with heat. That is really one of the eccentricities of English jurisprudence. We have a large number of Acts of Parliament called by curious names. For instance, we have an Act that says that contracts for the sale of land must be in writing. We call that the Statute of Frauds. There was an Act passed in 1909 under which Local Authorities prohibit Cinema Exhibitions from taking place on Sunday, and censor films that might be calculated to shock the youthful visitor. Well, we call that an Act "to make better provision for securing safety at Cinematograph Exhibitions." Those are the sort of eccentricities that you get in Acts of Parliament. It is rather the rule than the exception that a state of things should arise under an Act of Parliament that has nothing to do with the name of that Act. Now, the next step in this matter is that in consequence of promises made by Lord Ernle in 1917 to Canadian representatives, this subject was brought up in both Houses of Parliament in the summer of 1922. when the following Resolutions were passed:—

In the House of Commons:—

"That this House is of opinion that the time has arrived when the embargo on the import of Canadian Cattle should be removed."

And in the House of Lords:—

"That this House accepts the conclusions of the Royal Commission that the Dominion of Canada is free from cattle plague, pleuro-pneumonia and foot-and-mouth disease and is of opinion that steers from the Dominions might be admitted as store cattle to Great Britain, subject to precautions by means of quarantine being taken."

In consequence of these resolutions, an Act was passed last December entitled the "Importation of Animals Act, 1922." That Act authorises the admission of store cattle from Canada. So far as Canada is concerned, we have withdrawn unreservedly any suggestion that her cattle should be excluded on grounds of disease. The stigma to which she objected, which was imposed by the Diseases of Animals Act, has been removed by the

Importation of Animals Act of last year. I understand, however, that Canada is not completely satisfied and that she desires not only free import for her store cattle as defined in the Act, but also free access to our inland markets for her fat cattle. With regard to this request, I must point out that the British Government must have regard primarily to the interests of its own producers. I think that principle has been admitted more than once during this Economic Conference. Canada has been accustomed for the last generation to send us her fat cattle for slaughter at the ports. It is still open to her to do so. The removal of the embargo on store cattle does not justify a claim that additional privileges should be given to fat cattle, if, as most certainly is the case, the representatives of British agriculture are convinced that it would be detrimental to their interests. This definition of store cattle was inserted in the Act by the House of Commons without any pressure from the Government. It is not embodied in a Diseases of Animals Act, so that it casts no stigma on the health of Canadian cattle, whether store or fat, and it must be regarded as a matter of domestic policy adopted in the interests of our own producers. I cannot hold out any hope, therefore, that the Government will propose or that Parliament would accept any alteration of a decision that was deliberately arrived at less than a year ago.

The second clause of the Act authorises the Minister to admit by Order Canadian animals other than stores. Such Order, however, has to be approved by both Houses of Parliament. My predecessor, Sir Arthur Boscawen, had informed the Canadians of his intention to introduce such an Order at an early date and was under the impression that he would be supported by the agricultural interests of the country in doing so. When, however, I came to look into the question I found that that impression was based upon a misapprehension and that all classes of our agricultural community were strongly opposed to admitting breeding cattle into the country. So strong was that opposition that I thought it very unlikely that such an Order would be confirmed by Parliament. Probably it is not generally recognised what an important matter our pedigree herds are to English agriculture. They have been built up mainly by private effort, though latterly the Government has given some assistance, and although they comprise only a small proportion of the total stock of cattle in the country they influence the quality of a vast number of animals that are not pedigree. Our agriculturists are exceedingly nervous



about anything that would in any way reduce the class of our stock which we have done so much of late years to improve and they are firmly opposed to the admission of breeding cattle to this country.

**Mr. Massey:** You mean stud cattle?

**Sir R. Sanders:** Yes. It is only right for me to say that this applies to all breeding cattle and that the strong feeling of the great majority of agriculturists is against making any further relaxation of the present system.

So far as the majority of the Dominions are concerned, geographical considerations must limit the importation of cattle from the Empire to Great Britain to valuable animals which will realise a high price. Having regard to the paramount importance of safeguarding the interests of our own breeders and our valuable trade in the export of pedigree stock not only to the Dominions but also to foreign countries, the British Government, while anxious to promote inter-Imperial trade and to give the best possible terms to the Dominions, would not feel justified in doing more than to undertake to introduce legislation to facilitate the exchange of pedigree stock throughout the Empire as a whole on reciprocal terms, subject always to satisfactory precautions being taken against the introduction of disease.

**Mr. Graham:** Mr. President, I am not sure just why a question of this kind should be brought before the Economic Conference unless it be to provide a jury at the trial of this question. This matter was thrashed out for a great many years, Canada strongly objecting that the reason given for shutting out her cattle that they were diseased was not founded on fact, and full investigation has proved the truth of the contention. There was no reason in our mind to exclude Canadian cattle for very many years under the Animals Diseases Act. Now, it has been stated that it is an eccentricity, I might call it, of British jurisprudence, that you often call things by their improper names in the title of Statutes, as the question of protecting children in the cinemas, etc. Well, in that case, there was no stigma placed on cinema men, the Act was careful in its title—true to make it mean something it did not mean—but it was careful not to place any stigma on the business of the cinema men. But in this case for many years we have suffered under the allegation that cattle disease was rampant in Canada, which was not the case. I might add just here that,

although in a measure the embargo has been lifted, portions of our cattle under the enforcement of regulations are still suffering from the stigma, because when an inspector, in classifying the cattle landed declares that any cattle come under what might be called the "fat class," they are slaughtered on the dock as if they were diseased cattle under the Animals Diseases Act. There is no pretension by anybody that there is any disease in the cattle, they are not slaughtered because they are diseased, but are slaughtered because they are considered not to come under the technical stocker class. We think that is an incongruity and an injustice.

To come down to 1922, I must say with brutal frankness that the Canadian people are very much disappointed. After arriving at an agreement with the British Government along certain lines, we are disappointed to find out that the Statute passed did not comply with the terms of the understanding. There was a restriction defining "store" or "stocker" cattle placed in the Act which was not considered, I believe, at the Conference between the Finance Minister of Canada, the Minister of Marine and Fisheries, and the British Government. It has been stated that that was introduced by a private Member, and while I do not wish to criticise it, as that is the business of the British Government, I am inclined to think that, if the Government had resisted the amendment, it would not have been pressed, much less passed; but that is the business of the British Government.

Now I pass on to the present difficulty, because, if the Act had been passed as was discussed at the Conference, it would have left the door much wider open. I admit that there are difficulties in passing Statutes, in enacting Statutes in Parliament, perhaps on the inside that may not be discernible on the outside. I have had experience along that line myself. We have arrived at this stage. We do think that the Act, or that portion of the Act providing for the admission of breeding cattle or cattle capable of breeding should be made operative. It must have been so intended, else it would not have been placed in the Statute, and we feel that, while we cannot press it further, it is a fact that the British Government is not complying entirely with the understanding arrived at between the two Governments.

A matter that has not been mentioned is this. Provision has been made now for classification as between stockers and fat cattle and we contend that that was not anticipated in the Con-



ference. But even under the Statute as passed which contained the new restrictive clauses this inspection has been carried on not only with a detrimental effect to the Canadian cattle trade but with an injustice to the Canadian cattle trade. Stockers have to comply with certain restrictions—branding, detention and that kind of thing—to which fat cattle are not subjected. Then stockers have to be kept separate from fat cattle, and there are various restrictions to which what we call fat cattle are not subject. These cattle that are shipped as stockers from Canada arrive at the port in Great Britain, and it is our contention, we think based upon fact, that the spirit of the Act, the spirit of the arrangement is not being carried out but is being nullified by the details of the inspection. In other words, that cattle that are really stockers or store cattle and capable of being fed for weeks and months with great improvement are placed in the category of fat cattle when they arrive here, and are not even allowed to be taken a few hundred yards to another abattoir, but are slaughtered on the docks. They are slaughtered under the Animals Diseases Act though they are not diseased, with great detriment to the reputation of Canadian cattle. Further, these animals which we contend are not fat, are slaughtered and their carcasses must be sold. Canadian meat of an inferior quality is thus placed on the market. It is not fed up to the point of superiority of which it is capable, and Canadian beef is put down as an inferior article because the cattle are called fat by an inspector and slaughtered that neither we in Canada nor you in Great Britain would under any other circumstances think of slaughtering for the market. It is not out of place for me to give a detail or two. Several head of cattle were sent over here a few days ago by the Canadian Government as store cattle, cattle that in our country would be considered stockers, cattle that I have no hesitation in saying your farmers would call stockers if they owned them, and would feed them at least until the Christmas trade arrived. There were some 60 of these. They were all eventually put down as fat cattle and slaughtered; showing a distinct conflict of opinion between our experts in Canada and the inspectors here. I could give other details.

Another question has been raised which I do not think was ever in the mind of the British Government, and that is, inspectors have undertaken to say not only that cattle are too fat but that others are too poor. Surely that was not the intention that the inspector was to classify an animal as one that

should not be sold to a farmer to fatten if he wanted to buy it. There was in one shipment of cattle carried recently quite a number of exceptionally poor cattle. I had hoped to have had the photographs of them here to-day, but they have not arrived. These cattle were not considered too fat. They were considered too poor and not of the proper class of cattle for the British farmer to fatten. That surely is an intervention with trade not contemplated in the Act. To my mind under that Statute the inspector would have just as much right to inspect a horse of mine that I was selling over here and to say it was not fit for the market. The idea and the whole intention of the Act was that cattle should come over here to be fatted, and the class of animal would be a thing between the farmer here and the seller in Canada. I only mention that to show to what extent the inspection goes.

I do not know that I need go into any more details. We are thoroughly disappointed. I could read much stronger language than I would think proper to use, but we feel that not only are our farmers disappointed after being shut out of the market for 30 years on account of diseases which did not exist but that the agreement made is being disregarded. The door opened, cattle were coming in freely, and were being sold and purchased rapidly by the farmers here for fattening, but all at once, the door is in a measure closed. Now the shutting out of these fat cattle or of cattle that are called fat by inspectors, is of far greater moment than it may appear. It has this result, that the raisers and stock breeders in Canada are beginning to think that there is no use in endeavouring to take advantage any more of this market because they do not know whether an animal will be declared fat when it gets over here or not, and the slaughter of all these animals so declared to be fat animals, but which we contend are not, has always been done not only with loss to the immediate interest but to the detriment of the good name of Canada and the beef which our best cattle produce.

A suggestion was made by the Minister of Agriculture as to an arrangement for the interchange of pedigree stock. Possibly it would be of some benefit, but it will not cure the situation as to the exclusion of our good grade stock which might be capable of breeding. But the immediate trouble, and the greatest disappointment we in Canada have, is the fact that cattle we send over as we believe under the Statute are classified so as to nullify much of the good that should come to our trade under the Statute.



Then we cannot see why we should be used differently from any other Dominion. We would not at all say that any other Dominion should be deprived of anything it has on our account. Not at all. But we believe if trade is to be Imperial the benefits must be reciprocal. It is a fact, so I am informed, and is publicly stated in our Press, in an interview with the *Montreal Gazette* (perhaps one of the sanest newspapers in the British Empire) that Canada's cattle do not receive the same treatment as at least one other Dominion, in that their cattle after certain days of quarantine in England are allowed to be sold anywhere either as stocker or fat cattle. All those restrictions are put against our trade. As I said in the first place I am not sure this should be dealt with at the Conference as it is a matter between the Canadian Government and the British Government.

I have endeavoured to place our side of the case as impassionately as possible before the Conference. We think the spirit of the Act is being nullified by the system of inspection, and that the advantages which were intended to be had for Imperial trade are not being experienced; and as a result of it all, the Canadian farmer feels greatly aggrieved and greatly disappointed in that he is not getting what he was assured he was to get in the way of freedom of entry for his cattle into the British market.

**Mr. Bruce:** Sir Philip, I have got very little to say with regard to this matter. It is one, of course, which primarily concerns Canada. There is one point, however, I want to draw attention to, and, particularly, in view of the last few words that Mr. Graham uttered. He said he did not see why Canada should be treated differently from other Dominions. It is suggested that, while there may be some questions upon which there is a difference of opinion, Canada is being treated very advantageously as against any other Dominion at the present moment. Really that is the only point that I want to raise, and I do want to utter a protest with regard to it. It is that under the Diseases of Animals Act, 1894, we are excluded from this country, and there is an implied suggestion that there is some disease in Australian cattle. That I absolutely repudiate, and say that there are no possible grounds for any such suggestion. I appreciate all that Sir Robert said at the beginning as to the naming of Acts and so on, but none the less that is a position which I want to utter a protest against. As to the actual question under discussion, we have nothing to say about it, but it is true that it is not a trade with which we are actually

concerned, but we certainly do want to maintain the position which we have taken up very definitely indeed with regard to our own country. It is that we have a perfect right to take whatever action we consider necessary in the interests of our own particular producers. We take a very definite stand on that, and we say that nobody is entitled to try to dictate to us as to what we shall do for the protection of the people who are our own particular producers, and having taken that view, we certainly would not think for one second of attempting to force any other Government to take any action which was against the interests of their own particular producers, and I do not think it is dictated by a feeling of apprehension that we might be weakening our own position. I think we do accept that as a fundamental principle that we are prepared to adhere to, and naturally we could not express any views which could be interpreted as trying to force somebody else to do what we are certainly not prepared to do ourselves.

**Mr. Massey:** I hardly think that New Zealand is very seriously concerned in the shipment of live stock from that country to Great Britain. I do not think anything of the sort is possible; the voyage is too long. Of course, in saying that it is well to admit that stud stock are occasionally carried from England to New Zealand and a few the other way. Every year a certain number of horses and cattle are shipped and I suppose that will continue.

**Sir Robert Sanders:** The trade in horses is perfectly free.

**Mr. Massey:** I am glad to hear that. I just want to emphasize the point which has been referred to by the Prime Minister of Australia. So far as disease is concerned we have practically none. I want to qualify that by saying that I believe we have probably the same proportion of tuberculosis in our cattle as will be found in every other country in the world. There is no country that I know of free from tuberculosis, but in stock we have no such thing as foot-and-mouth disease, and I know you have had it here pretty often. We have no anthrax; I have heard of that in the United Kingdom. I am glad to think that measures have been taken to stamp them both out. So far as I know, neither of those diseases is prevalent in England at present. Horses are not affected by what is proposed, but I want to raise this point. You have a big exhibition coming on here next year which I hope will be a tremendous success, and, if so, I believe it will do every



country in the Empire a great deal of good. What are you going to do with regard to stock coming over for that exhibition?

**Sir Robert Sanders:** There is a clause in the Act of 1896 by which the Board may make such Orders as they think fit for allowing the importation of foreign animals for exhibition purposes.

**Mr. Massey:** Will there be permission to dispose of them in this country? I may say I was consulted about this before I left New Zealand, and the opinion I expressed was simply that I hardly thought either cattle or horses would be sent to England for exhibition purposes. New Zealand is one of the countries where stud stock does not deteriorate. I believe we could with advantage send over some sheep that would be an object lesson to Britain. I am speaking of the breed peculiar to New Zealand—Corridales. They have spread very rapidly all over the Dominion and they are useful both for mutton and for wool. I should like to know something definite about it. I do not say our people do not want to send horses. I only say that, in my opinion, it would not be worth while. You have had very good horses imported from New Zealand before to-day. I would like to know what is going to be done definitely with regard to the animals coming from overseas for the exhibition, whether they would be allowed to be disposed of here, because it would be of no use bringing stock here and intending to take them back. Very few people could stand the expense and I would not be inclined to encourage it.

**Sir Robert Sanders:** They would be in very small numbers.

**The Chairman:** The exhibition would not hold a great lot of them.

**Mr. Massey:** I presume each country finds room for its own exhibits.

**The Duke of Devonshire:** I am not speaking as Colonial Secretary now, but as connected with the British Empire Exhibition. If you send the stock and it is allowed to come by the Sanitary and Local Authorities of Wembley, who may have to be consulted in the matter, I will undertake to say that you will be able to get rid of it to the best advantage you can.

**Mr. Massey:** That is something definite and I am very glad to get that. It would not be satisfactory if I could not tell my people something definite when I go back. There is another point. I am raising this in the interests of British

agriculturists as well as my fellow citizens. If they want to benefit themselves let them look at the fact that South America is gradually taking possession of the whole beef market in Britain. That is the position to-day. I can only speak from memory, but I believe that last year 5,000,000 quarters of beef came into this country from South America, and I know perfectly well that the British farmer cannot produce fat stock—I am speaking of cattle—anything like so cheaply as the man in the Argentine can, or one of the other States there, and send it to England.

I am interested, of course, as representing a great producing country, but I think the interests of the British agriculturists come even before those of the New Zealand farmer and are very much more seriously affected. I am not worrying about lamb and mutton. We can beat them in lamb and mutton every time, but we simply cannot stand up to them with beef. I have advised New Zealand to drop the shipment of beef and go in for something else. I do not know that I have anything more to say. I am very glad to have this statement from the Duke of Devonshire with regard to the exhibition of stock which New Zealand is inclined to send.

**Mr. Burton:** This seems to me to be really a matter for settlement between the Dominion concerned and the British Government more than for this Conference. I have nothing to say about that, but I should just like to say that I welcome the statement made by Sir Robert Sanders with regard to the promise to facilitate this exchange of pedigree stock. As far as I am aware that would be of considerable value to South Africa and I look at it from that point of view.

**Mr. Riordan:** As the statement made by Sir Robert Sanders in no way affects the interests of the Irish cattle trade, I shall not delay the Conference with any further remarks.

**Mr. Mackenzie King:** In the first place, I would like to mention again what I said at the opening meeting, that we appreciated in Canada the difficulties with which the British Government were confronted in this matter and appreciated sincerely the action of the Government in seeing that the embargo was removed, giving admission to our cattle. We wished to do something more than give verbal appreciation of that action, and we increased the British preference, amongst other things, in the hope that the British public would realise that having met us in a matter in which we were vitally concerned



we, in like measure, would like to meet them in a matter which was of concern to British interests. We increased our preference by giving an additional 10 per cent. discount on the existing preferential duties on all goods coming through Canadian Ports. I want to make it clear that this was done largely as the result of the action of the British Government in respect to the admission of our cattle. We intend to hold to what we have done.

Our attitude in the matter of preference is one of trying to further as much as we can inter-Imperial trade. The point which I think we would stress most strongly—and it is a point, I think, which is felt equally on this side—is the importance of carrying out whatever agreements may be reached in the spirit as well as in the letter. We have no desire to do other than live up to an agreement that we have made, and we expect the British Government to adopt the same attitude, not only by itself and its Ministers, but through its officials. We think the officials should be definitely instructed as to what is the agreement and understanding in this matter. As Mr. Graham has pointed out there was a definite agreement made between the Ministers of the Crown of Canada and the Ministers of the Crown here, as to what was to constitute the provisions of an Act of Parliament. That agreement was altered somewhat by an amendment of the Act. That was a disappointment, but we realised that the Government had its difficulties in a measure of this kind when it came into the House of Commons and the House of Lords.

However, the Act itself stands for the voice of the British Parliament, and at the moment we find a further disappointment in that the Minister of Agriculture tells us distinctly that, though the Act has a clause referring to the admission of breeding cattle, which has been framed with a view to giving practical expression to another phase of the agreement, he will find it impossible to introduce the Order which would give force to that clause of the Act and make it of service to us. That must necessarily occasion another considerable disappointment. It distinctly cuts down the value of the legislation and distinctly limits what we hoped and expected would be the outcome of the agreement.

Now, as to the difficulties, there again let me say that our Government are prepared to be as considerate in every particular of the difficulties with which the British Government is confronted as can reasonably be expected, but there is a limit to which consideration can go. If the Act in its provisions is to

be whittled away clause by clause and what is left to be completely whittled away by the method of administration, of what avail is it? That brings me to the last point, namely, the administration and regulations in regard to the admission of store cattle. As Mr. Graham has pointed out, that is really very serious, because it affects our cattle in two ways. In the first place, it brings back a certain stigma which the Minister has rightly stated was never justified, and which the British Government is anxious to have removed completely, but in the second place it gives to our beef in the British market a reputation which it does not deserve. Indeed, it may conceivably help to destroy the very trade it was intended to further. If we send our cattle in as store cattle, lean and thin, and with the intention of having them fattened here, and they are slaughtered immediately and put on the British market as Canadian beef, it will not take very much in the way of marketing that kind of beef to destroy any reputation our cattle may have. One can see how the farmers of Canada would naturally be very sensitive on a point of that kind. I believe if the Minister of Agriculture will say that in the carrying out of the legislation he will see that instructions are given to his officials to the effect that the spirit of the law must be lived up to, and that Canadian cattle coming in as store cattle must not be put into a classification into which they should not properly be placed, he will go a long way to remove what Mr. Graham rightly referred to as a feeling of great disappointment and some indignation at the moment. I think it is entirely to the interests of British trade with Canada and our trade with Britain that irritations of that kind should not be permitted to develop. If they start on one side there is apt to be retaliation on the other, whereas all that we want is to carry out whatever agreement we have in a spirit of goodwill and liberal interpretation.

I might mention a concrete case that was brought to my attention this morning, of a shipment of cattle that was sent over from Canada to two different ports. The single shipment was divided into two lots, one lot of 50 being sent to one port and the other lot to another port. At the one port those stockers were classified as fat cattle and slaughtered immediately. At the other port they were admitted as stockers and so regarded.

**The Chairman:** All out of the same lot?

**Mr. Mackenzie King:** Yes, all out of the same lot. I do not mind saying that our shippers are anxious to find out how the law is being administered. This I believe was done



designedly by one shipper who divided his shipment into half and sent half to each of the two ports, at the one port they were slaughtered immediately, at the other port they were admitted and regarded as store cattle. That is an actual fact within the past week. It bears out what I say, that some of the officials of the Departments are evidently over-zealous in taking a certain course, at some ports at least, and I think that what is most needed is that the Government itself should make known to its officials the view that was expressed by the Government to our own Ministers.

**Sir Robert Sanders:** With regard to this question about the store and fat cattle, what the officials of my Department have to do is to carry out the words of an Act of Parliament. The words of the Act of Parliament are that the cattle "must be intended for feeding purposes and not for immediate slaughter." Of course, as I said in the House of Commons once, it is a very difficult thing to calculate the exact amount of obesity that would justify immediate slaughter. I will have it looked into, certainly, but the officials of the Department are as competent men as you can find for judging what, after all, is a somewhat difficult question.

As to the question of the cattle that are too poor, I should like to have further particulars, if Mr. Graham would let me have them. I should be very happy to have the case looked into.

In the course of further discussion the Dominion representatives welcomed the suggestion that arrangements might be made for the reciprocal exchange of pedigree stock, and the Minister of Agriculture agreed to discuss with the Canadian representatives the points they had raised as to the administration of the Act regulating the importation of Canadian Store Cattle.

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## THE PREVENTION OF BUNT IN WHEAT.

THOUSANDS of bushels of wheat are lost annually in England through neglect of a proper pickling of seed wheat against bunt. When a diseased crop is threshed most of the bunted grains burst, the fine black spores are liberated in clouds and the healthy grains become coated with them. Winnowing may be sufficient to remove unburst bunted grains and broken fragments, but it obviously cannot free the grain from the spores. Grain may also become contaminated from the thresher if the latter has been used previously to thresh the produce of an infected crop, and previously used sacks have been known to contaminate seed corn placed in them in the same way.

The manner of infection is through the young seedling wheat. The spores are carried on the grain and germinate on the softening coat. Once in the plant, the fungus spawn grows with it, maintaining itself near the apex of the plant, and when the ear is formed it makes its way into the young grain. As the plant food passes into the ear for the growth of the grain, the parasite seizes upon it, destroys the tissues, and eventually produces a solid mass of black spores in the grain.

The pickling of seed wheat by a solution of formalin has been tried on a large scale and found reliable. (Formalin is a liquid containing approximately 40 per cent. of formaldehyde gas in solution.) The Ministry recommends the use of this, the solution being at the rate of one part formalin to 320 parts of water (*i.e.*, 1 pint formalin to 40 gallons of water). Mr. E. S. Salmon found that complete control of bunt was secured by using formalin at the rate of 1 pint to 60 gallons of water. From one to two gallons of the solution should be sufficient for four bushels of wheat. It should be slowly sprinkled or sprayed over the grain, which should be stirred, so that all the grains become thoroughly moistened. The solution should not be allowed to form pools under the heap of grain. The seed should then be placed in a heap and covered with sacks soaked in the solution, but not too wet. The seed may then be left for four hours, after which it should be spread out to dry on a clean floor which has been disinfected by formalin solution and allowed to dry before the seed is spread upon it. The sacks in which the seed is to be placed should be treated with formalin solution in the same way, or boiled in water and subsequently dried. Seed wheat treated as advised suffers slightly in germination, and should therefore be sown a little thicker than is usual.



## PIG-KEEPING.

## III.

W. A. STEWART, M.A., B.Sc. (Agr.),  
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**Systematic Rationing.**—The quantity of food required by a growing or fattening pig will depend largely upon its size, and this can be gauged approximately by its weight. Generally speaking, a growing or fattening pig will need about 1 lb. of mixed meal for every 20 lb. of live weight. This is, roughly, equivalent to 1 lb. for every 4 weeks of age. On this basis we can construct the following table which may be taken as a guide :—

TABLE I.

<i>Age.</i>	<i>Approximate Live Weight.</i>	<i>Total Meal per head per day.</i>
3-6 weeks.	20-30 lb.	1-1½ lb.
6-12 "	30-50 "	1½-2½ "
12-16 "	50-80 "	2½-4 "
16-20 "	80-120 "	4-5½ "
20-24 "	120-170 "	5½-7½ "
24-30 "	170-220 "	7½-9 "
Sows in pig	- - - -	4-6 "
Sows in milk	- - - -	8-10 "
Stock boars	- - - -	4-6 "

It should be recognised that these figures are simple representative of a large number of average cases. It is quite possible that breeders and feeders can quote higher weights secured with less liberal diets at earlier ages, but we are not dealing with exceptional cases.

It is doubtful whether it is ever economical to exceed 9 lb. of meal per day to a fattening pig. Even when as much as 9 lb. is given some considerable proportion may pass through undigested in the dung. It is generally advisable to replace some part of the meal ration by using roots or greenstuff. The following figures show the weights of roots and forage crops which are roughly equivalent to 1 lb. of barley meal.

Potatoes	...	...	...	...	4 lb.
Rape, vetches, lucerne, grass...	...	...	...	...	8-10 lb.
Mangolds, swedes	...	...	...	...	9-11 lb.

**Rations for Different Classes of Pigs.**—Working on the figures for albuminoid ratios and total quantities which have been suggested as guides, and taking such well-known feeding

stuffs as fish meal, linseed cake, pollards, barley meal and bran, rations could be compounded as follows:—

TABLE II.

Age of Pig.		Fish Meal.	Linseed Cake.	Pollards.	Barley Meal.	Bran.	Quantity of mixture per head per day.
							lb.
3-6 weeks	...	10	10	70	10	—	1-1½
6-12 "	...	10	10	50	30	—	1½-2½
12-16 "	...	10	10	30	50	—	2½-4
16-20 "	...						
* Bacon pigs	...	10	10	20	60	—	4-5½
* Pork pigs	...	—	10	20	70	—	4-5½
20-24 weeks							
Bacon pigs	...	10	10	20	60	—	5½-7½
24-30 weeks							
Bacon pigs	...	—	10	20	70	—	7½-9
Sows in milk	...	10	10	50	20	10	8-10
Sows in pig }							
Stock boars }	...	10	10	40	40	—	4-6

\* Different rations are given for bacon and for pork pigs of these ages because the pork pigs will be slaughtered at say 20 weeks old and should have a ration with a wider albuminoid ratio than pigs being fed and kept on to 28-30 weeks old for bacon.

The feeding stuffs used in Table II are particularly safe and have been found to give excellent results, but they are sometimes expensive, and at times it may be economical—more especially in the case of pigs over the age of 12 weeks—to introduce other and cheaper feeding stuffs. Palm kernel cake and rice meal are frequently the cheapest feeding stuffs on the market, and if green food is used with them they can be employed with satisfactory results. In the special cases, however, of young pigs under the age of 12 weeks and sows in the early stages of suckling their litters, unless linseed cake, pollards, barley meal and bran are very much more expensive than other feeding stuffs it is doubtful whether it is really economical to substitute other feeding stuffs in their place.

TABLE III.

*Rations including Cheap Feeding Stuffs such as Palm Kernel Cake and Rice Meal.*

Age of Pig.		Fish Meal.	Palm Kernel Cake.	Pollards.	Barley Meal.	Rice Meal.
12-16 weeks	...	10	20	20	25	25
16-20 "	...					
* Bacon pigs	...	10	20	10	30	30
* Pork pigs	...	—	20	20	30	30
20-24 weeks						
Bacon pigs	...	10	20	10	30	30
24-30 weeks						
Bacon pigs	...	—	20	20	30	30
In-pig sows and		10	20	30	20	20
gilts and boars	or 10		20	30	40	—

\* See footnote to Table II.



TABLE IV.

*Rations composed of Home-Grown Feeding Stuffs and Fish Meal.*

<i>Age of Pig.</i>		<i>Fish Meal.</i>	<i>Beans.</i>	<i>Wheat.</i>	<i>Barley.</i>
		%	%	%	%
12-16 weeks ...	...	10	25	25	40
16-20 "					
* Bacon pigs	...	10	20	20	50
* Pork pigs	...	—	20	20	60
20-24 weeks Bacon pigs		10	20	20	50
24-30 " "	"	—	20	20	60
In-pig sows and gilts and boars	...	10	25	25	40

\* See footnote to Table II.

Other feeding stuffs such as maize gluten feed, palm kernel cake and coconut cake could be used in place of beans. Maize germ meal might be used to replace wheat, and maize might be employed as a substitute for barley. Any number of different rations can be made up in this way, and the feeder should consider carefully current market values with a view to effecting economies in the making up of rations.

**Feeding.**—All changes both in quantity and composition of the ration should be brought about gradually. The pig should never be given more wet food than it will readily clear up. If it receives too much it may overeat and upset the digestion. This will cause a check in the rate of growth and development. Such checks do not appear to occur with dry feeding, even though an unlimited supply of food is given, provided that a slow-acting automatic feeder is employed. One of the commonest errors in wet feeding practice is the use of too much water. The food when soaked should be fed normally as a thick porridge, but the quantity of water requires to be varied according to the weather. Meals should be given regularly. Theoretically the oftener the pig can be fed the better. Three meals per day give better results than two, but it is doubtful whether it is economical to feed oftener than three times daily. Two meals daily is the common commercial practice, which is quite satisfactory. When a pig suffers from constipation or goes stiff through overeating the quantity of food should be temporarily reduced and the diet changed for a time to pollards with a small proportion of linseed cake and bran. Frequently too much starchy food, such as barley or maize, is given to young breeding stock. This produces a soft "flabby" appearance, and if continued to excess may interfere with the breeding capacity.

Young pigs will usually begin to eat at 3 to 5 weeks old, this variation in age depending upon the size of the litter and whether or not the sow is a good milker. At this age new or separated milk is particularly valuable, but the mixture of pollards, fish

meal, linseed cake and barley has given excellent results. This mixture can be used either wet after being soaked or simply dry. When given dry it is most important to see that the little pigs get all the water they need. They should have free access to a water supply. On dry food little pigs are less liable to scour and less likely to develop "paunchiness" than when fed on sloppy food.

It should not be overlooked that no matter how correct the ration may be as regards composition and quantity, good results will not be obtained unless a careful watch is kept upon the pigs and the closest attention paid to the other details of management. If the housing conditions are wet, dark, damp and insanitary, pigs will not thrive. Exercise, fresh air, sunshine, a dry bed, and green food are all as essential as a well balanced ration. It should not be supposed that the pig can live under any sort of conditions without care and consideration. Neglect very soon leads to disaster. It should be remembered that the pig is the most prolific animal and the most rapid grower on the farm. This being so, it all the more needs and deserves reasonable care and attention.

So much has been written on the subject of vitamins that certain pig keepers are very apt to conclude that all their troubles are due to vitamin deficiency. Our experience suggests that the cases of actual vitamin deficiency are probably comparatively few. Much commoner causes of troubles are badly bred pigs, unhealthy and insanitary housing and surroundings, dirty troughs, badly balanced rations, too much water in the food, insufficient attention, and failure to recognise incipient illness or disorders. No one should take up pig-keeping hoping to make it profitable unless he or she is thoroughly interested in it and, being endowed with an open yet critical mind, is prepared to learn both from the accumulated fund of practical experience and the lessons of experimental science.

NOTE:—With reference to the inclusion of fish meal in Tables II, III and IV, it should be pointed out that the Ministry's Leaflet No. 333, which deals with this feeding stuff, is not at present being issued. Its temporary withdrawal was due to representations made to the Ministry by the Pork Section of the National Federation of Meat Traders Associations, which left no doubt that owing to carelessness, both with regard to the quality and the quantity of fish meal fed to pigs, tainted pork and bacon are of somewhat too frequent occurrence.

It should be possible, however, to use suitable brands of fish meal up to within four weeks of killing, with perfect safety as regards tainting, if sufficient care is taken not to exceed the proportion recommended. The rations in the tables are designed with the idea that fish meal is omitted during the last four weeks of feeding.

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## FOWLS ON THE FARM.

J. W. HURST.

DURING 1922 the poultry produce imported into the United Kingdom (mainly Great Britain) from countries abroad, exclusive of Ireland, exceeded £15,000,000 in value; and the Irish exports, nearly all of which entered Britain, approximated to a value of £11,000,000 in 1921. These are big figures, yet it is to be noted that the quantities of eggs and poultry imported fall considerably short of pre-war dimensions. The warning given by the Departmental Committee on Distribution and Prices of Agricultural Produce is to the effect that "producers in those Continental countries which, owing to internal conditions, have temporarily ceased to export poultry produce to these shores will sooner or later seek to re-enter the British market."

On the other hand, the estimated value of the production of eggs and poultry on the agricultural holdings of Great Britain in 1922 is given as £16,000,000 (Part III, *Agricultural Statistics*, 1922). This estimate does not include the production of fowls kept by cottagers and private residents, and these have been assumed to be about one-third as many as the birds kept on agricultural holdings. However that may be, it does not affect very materially the obvious conclusion that farmers, as such, have an immense opportunity for the development of poultry keeping as a specific branch of their work.

It is, perhaps, necessary at the present time to reaffirm and emphasise the fact that the great bulk of the eggs and table poultry produced and marketed in this country are the output of general farms, and that it is mainly in connection with other uses of agricultural land that there exists such scope for that expansion and development that alone will resist foreign competition. It is true that there has been a remarkable increase in the number of commercial egg farms during the past few years, but the combined output of such establishments is very small by comparison with the farmers' bulk of poultry produce.

Nevertheless, this production in the past has been almost fortuitous, and farmers as a class have not yet begun to realise the extent of the influence they are capable of exercising upon the egg and table poultry trade of this country. Until quite recent years the fowl on the farm was regarded rather as an

unconsidered trifle than a business proposition. It has remained for specialist breeders to provide proof—through the medium of the egg-laying tests—of the possibilities of prolificacy and profit that exist in the poultry industry. Yet the mere multiplication of specialist breeders, and the efforts of commercial egg farmers, will probably not be commensurate to the needs of the future, or sufficient to enable the home industry to take full advantage of the more immediate opportunity.

The chief hope in this direction lies in the largely unrealised and at present latent power of general farmers to develop egg and poultry production as a serious branch of agriculture. The general farmers throughout the country are the only people who are in a position to increase the aggregate output sufficiently without avoidable loss of time. They also are, as a class, able to do so under the most favourable economic conditions.

**Advantages of Position.**—Farmers are already in occupation of the required areas of land. They have no need for any great capital expenditure upon plant, their fowls find the most suitable accommodation imaginable, and their produce need carry no undue proportion of establishment charges. Moreover, his knowledge and experience of live-stock keeping generally should enable the average farmer to appreciate broadly the requirements in this branch of production, and to realise the benefits that result from good management. The agriculturist, therefore, possesses special advantages that qualify and equip him more particularly than others to make the most of the opportunity that exists in this direction. Circumstances have recently combined to turn his attention more seriously and definitely than hitherto to remunerative side lines. These must bulk more largely now than formerly in his plans.

There are considerable and essential differences between what is termed commercial poultry farming and farm poultry keeping. The former necessitates a relatively big initial outlay, a reserve sufficient to meet all expenses—including living—until the enterprise is established upon a paying basis (usually for a fairly long period), and the fowls have to bear all, or most, of the rent, labour and other charges, in addition to such costs of production as are inevitable under any conditions. Further, an outbreak of disease may at any time destroy the chief or only source of income. Farm poultry keeping is not similarly handicapped, as regards capital expenditure or costs, whilst the loss from epidemics is more easily avoidable, and the results of a possible outbreak far less crippling.



Penning arrangements, so far as they may be necessary on the farm, are much less elaborate and expensive than they must necessarily be on the poultry farm proper. The burden of rent is offset by the value of the manurial product on agricultural land. Feeding is very much less expensive, under ordinary good management. Further, investigators have found that the profit on capital employed is capable of being greater in the case of poultry than in connection with several other branches of production on farms. It has been shown, indeed, that in several instances the production of eggs and poultry has been the only consistently profitable branch, on a group of farms kept under observation, under the conditions that have prevailed recently.

**Benefits to Cultivation.**—The relation of poultry keeping to general farming, and fruit growing, was discussed in considerable detail at a conference held this year at the Harper Adams Agricultural College, and many extremely interesting facts were put forward in proof of the profitableness of fowls as an adjunct to cultivation. The benefits to the land and the growth of crops that result from the distribution of the nitrogenous manure deposited by the birds was clearly shown to be in itself amply sufficient to free the fowls from a charge for rent; whilst, in addition, the greater health and freedom from damage and disease of trees and plants, due directly to the destruction of pests of various kinds, is an increment of almost inestimable value. This holds good in respect to both fruit and farm crops.

From the farming point of view, therefore, poultry under good management aid cultivation, altogether apart from the possible profit on their produce—and the margin of profit is widened by the economies of farm poultry keeping by comparison with those of poultry farming. In spite of these well-authenticated facts the agricultural land of the country is notoriously very greatly understocked with fowls, in relation to the number which it would carry without any interference with its other uses for stocking and cropping.

**Food and Labour Costs.**—Fowls kept on the general farm necessarily cost considerably less to feed than those that are kept by specialist egg farmers. They have a very much larger proportionate range, and when distributed judiciously (as they must be in accordance with the method of cultivation) they find a large amount of natural food by foraging over pasture, arable (including stubble), and woodland. A great part of the food supplied, in addition to that which they find, is frequently grown on the farm that carries the fowls, including grain, green

stuff, roots, clover hay, etc.; and, whilst meals must necessarily be obtained from the miller, the purchase of such mash ingredients as meat meal or fish meal may often be obviated by the availability of other and cheaper forms of flesh food.

The question of labour, however, requires much more particular consideration than it has usually received in the past in regard to farm poultry keeping. It is evident that if the fowls are to produce the highest possible return they must be put in charge of some particular person or persons possessed of sufficient special knowledge to manage them to the best advantage. This is obviously as true of the poultry department as it is of any other branch of live stock kept on the farm. It may or may not be a whole-time job. That is a matter that depends upon the circumstances of the individual farmer. If the operations are sufficiently extensive it should prove profitable to employ a properly trained poultry man or woman, or, as some large occupiers of agricultural land have done already, engage a game-keeper to take control. Under some conditions it has been found most satisfactory to pay a bonus to one or more of the labourers with an aptitude for the work. A farmer in the south-east who rears some thousands of table chickens annually pays his men threepence for each bird brought to a fattening age and condition. The same principle could be applied in some circumstances to egg production.

**System Essential.**—In any case it is essential to systematise the poultry work on the farm, and this necessitates the putting of some capable person in charge, with full responsibility for results, whether as a sole occupation or in conjunction with employment in other directions, although the opportunity for such other employment would in most cases be seasonal rather than regular. This is, however, a matter for regulation to suit particular and individual needs; the main point is to ensure the responsibility of some person or persons, of ability equal to that of those in charge of the several kinds of bigger live stock. Given this ability, and the suitability of the stock, the better returns should much more than compensate for the relatively small addition to the cost of management.

The suitability of the stock is, of course, a vital factor. It is necessary to raise the level of quality of the fowls kept on, probably, the great majority of the farms in Great Britain. It is not only desirable to increase the head of stock on farms generally, but it is essential that farmers should keep the best birds only, to ensure the maximum individual output, whether



of eggs or chickens. The lessons of milk recording may be applied equally well to this branch of production. Just as it pays better to own a few deep milkers than many more animals of average class, so also is it more remunerative to stock a smaller number of fowls of a prolific strain than several times the number of mediocre birds. The keeping of egg records is as economically important as the keeping of milk records; it is essential to maintain a good flock-average of production.

In the selection of breed, however, the main purpose of production must dominate the choice, but the farmer must bear in mind that the egg specialists have made considerable use of sitting breeds in making laying strains. This has resulted in some amount of breeding-out of the incubating instinct, and in the reduction of the table qualities of the strains of general purpose breeds that have come under this influence. The main purpose of the farmer may be egg production, but he usually requires at the same time a class of cockerel that will make a passable table bird. The farmer, too, is wont to depend upon the broody hen to hatch and rear, to a much greater extent than many other poultry keepers.

The level of production should be set at a reasonable height in relation to the type and general characteristics of the breed in question. For instance, a flock-average of 170 to 180 eggs per bird per annum would be excellent on the commercial egg farm, where egg production is the chief object; it would be higher than most—150 is probably nearer the average. But the attainment and maintenance of any such yield depends upon strain as well as breed, and if birds are expected to breed good table chickens as well as to produce a reasonable number of eggs, the output of the latter must not be so developed as to detract from the suitability of the former. The yield of fowls kept under farm conditions may fall somewhat short of what is attainable under more artificial methods of management, but the costs of production are lower, and with a breed and strain capable of laying comparatively well in autumn and winter the average profit should be satisfactory. The general farmer will usually be well-advised to make choice of a general, or dual-purpose breed, and to make sure that the birds are of a type to justify the description.

**Organisation of Marketing.**—Finally, there is the question of marketing, and unless the present methods are altered efforts to increase and improve production will be very largely nullified. If poultry keeping is to be brought more generally into the

scheme of farming, the marketing conditions and facilities must be so arranged that they give the required encouragement to enlarge the output. It is quite evident that the solution of the marketing problem is to be found in some method of co-operation sufficient to direct and control the system of distribution. It is here that farmers as a class have at least the nuclei of the required organisation already at their command, in the existing agricultural co-operative societies, a few of which have, indeed, established branches for the sale of eggs and poultry. Whatever method may be deemed best for the local purpose, the need for some central control of distribution—as recommended in the report of Lord Linlithgow's Committee—cannot be gainsaid.

That the generality of farm producers could do very much better than they have done hitherto is evident from the experience of those who have made the experiment of marketing upon a co-operative basis, as, for instance, in East Anglia. In Denmark, the most commonly quoted example of this form of co-operative endeavour, there is a central society which embraces about 540 affiliated local bodies of producers, and the success of their operations is a matter of common knowledge. There has also been a noteworthy development of the co-operative method of dealing with eggs in the United States of America; and, in short, it is the well-organised co-operation of our foreign competitors against which our home producers have to contend in their own home markets. They can no longer afford to ignore this economic weapon, which they must, perforce, adopt in defence of their own trade and its development. Farmers are better able than any others to put the required machinery in motion.

All the conditions combine to make the present time favourable to the development of egg and poultry production upon the general farms of Great Britain, and to the consolidation of the home producer's position in the home market. Here, at least, is one industry the retention and enlargement of which is within our grasp, and farmers are the only class in a position to seize the opportunity promptly and to meet the demand upon a big enough scale.



## NOTTINGHAM COUNTY EGG LAYING TRIALS.

J. A. CASEBY,

*Small Live Stock Instructor, and*

R. N. DOWLING, N.D.A.,

*County Agricultural Organiser.*

NOTTINGHAMSHIRE is a county that offers good prospects to commercial poultry keepers on both farm and small holding, for there are good markets close at hand and soil and climatic conditions are suitable. The number of poultry farms is comparatively small, but there are very large numbers of individuals who devote part of their time to poultry keeping and who look upon it as a business proposition. An account of the County Laying Tests which have been organised by the County Small Live Stock Instructor is of special interest as showing how such trials can be run on self-supporting lines without financial aid from the local authority or the Ministry.

Inquiries were made among poultry keepers in the county as to the possible support in the form of entries for competition that might result in the event of a County Egg Laying Station being set up, and it was soon evident that there would be no lack of competitors. As each would pay a proposed fee of £1, a fairly certain revenue from this source could be relied upon.

Then came the question of the necessary equipment, in the form of poultry houses, wire netting, posts, etc. A firm of poultry appliance manufacturers was approached with a proposal which, after consideration, its principals agreed to, namely, that they should provide practically the whole of the equipment on a loan basis, and that the county should have the option of taking it over at a price at some future date, should they so desire. This arrangement made it possible to proceed with the scheme.

The next step was to find a suitable centre and farm, with a reliable manager to carry on the work of feeding and general management, who would undertake this without payment beyond the proceeds of the sale of eggs.

Several possible centres were examined, and it was finally decided to establish the station on Mr. S. V. Playle's poultry farm at Mapperley, Nottingham. This farm is situated within easy access of Nottingham, and can be reached by tram from any of the railway stations in the city. The situation is a very exposed one, being some four hundred feet above sea level, wind-swept, and sloping to the north. The birds are therefore severely

tested for stamina as well as egg production. The soil is a very heavy clay, and is of the Keuper Marl geological formation.

It was felt that whatever success was obtained under these conditions would prove beyond doubt the possibility of keeping poultry successfully anywhere in the county.

**Equipment of Pen Section.**—In the first test, 1921-22, there were 20 houses and runs and a large two-compartment hut used as a food store and office. In the second test, 1922-23, six extra houses and runs were put up to enable 26 pens to compete. The pen houses are of the Lancashire Cabin type and measure 6 ft. x 4 ft. x 5 ft. Each house has a floor raised on bricks, and six windows, the glass being removable. There are four nests and also a dropping board and one perch. The runs are 25 yd. by 6 yd. and each run has a gate opening on to the avenue. A metal water fountain and metal grit box hang on the outside of each house, and a V-shaped trough is used for the crumbly feed.

**Equipment of Single Pullet Section.**—The large hut used in 1921-22 as a food store and office was converted into a poultry house by putting an exit door for the fowls in the front of each compartment. Six trapnests were put in each half and also a dropping board and perch. There are four large windows in the hut, and the upper half of each window is hinged to allow for greater ventilation. The outside runs are 50 yd. by 12 yd. and about 20 pullets can be run in each of the two sections of this test. Mixed heavy breed pullets are in one half, and mixed light breeds in the other.

**Management.**—Mr. Playle has acted as manager and personally does the work of feeding and egg recording, and is responsible for the labour for cleaning and disinfecting the houses and watering the birds. The feeding in the morning is of warm crumbly mash, which is fed in troughs at dawn. The system of feeding on a well-balanced ration is carried out carefully. Each pullet gets as much mash as it requires, and heavy laying means more food consumed. The mash is composed of high-grade meals as follows:—

<i>Parts by weight.</i>				<i>Parts by weight.</i>			
Middlings	...	...	4	Fish, meat and bone mixed	...	...	1
Sussex ground oats	...	...	2	Dried yeast	...	...	1
Flaked cooked maize	...	...	1	Alfalfa	...	...	$\frac{1}{2}$
Biscuit scrap	...	...	1	Charcoal	...	...	$\frac{1}{8}$

A very small quantity of cod liver oil is added during east winds, frost or snow. Cabbage is given when the grass loses its nutrient value. The albumenoid ratio of the meal mixture is 1 to  $3\frac{1}{7}$ . This appears to be a rather narrow ratio, but it is





FIG. 1.—Type of House used at Nottingham County Egg Laying Trials.  
Runs 25 yd.  $\times$  6 yd.



FIG. 2.—Divided Poultry House with two large runs.





widened considerably when one takes the grain portion of the ration into account.

The afternoon feed is composed of sound cereals such as wheat, oats and cracked maize in rotation, buried in a good depth of chopped straw and chaff. The houses are cleaned out on alternate days, and the dropping board and perches lime-washed weekly. The water fountains are replenished daily, and the grit and shell added to the hoppers as required.

Egg collection is done as late as possible each day, to ensure getting all eggs laid that day and the number is recorded on the record sheet, and also the pen number on the egg. Broodies are removed to broody coops with a slatted bottom raised on legs. The broody pullets are fed and watered while shut up, and returned as quickly as possible to the pen when it is seen that they stop "clucking."

**The Objects of the Test.**—These can be looked at from two standpoints: (1) That of the Nottinghamshire Education Committee, and (2) that of the individual competitor. Laying tests show farmers how it is possible to get paying numbers of eggs in winter. They act as demonstration centres (as many as 250 people have been at the Nottinghamshire test in one day). They are a guide to poultry keepers as to where the best laying strains are bred, and high-grade stock is distributed by them throughout the county.

Taking the competitor's standpoint we have the advertisement for his stock, the possibility of winning valuable prizes, and the profit from the sale of eggs.

With the following reservations the manager retains as his property all eggs laid. *The public* can purchase eggs for hatching from, say, the leading pen at 15s. per doz. when eggs are, say, 2s. 6d. retail; *the owner* of the pen receives the 15s. less the retail consumption price which the manager receives, and 6d. per doz. which the Education Committee receives. *A competitor* can purchase eggs from his own pen at retail consumption price plus 6d. per dozen. *The manager* can set for hatching any eggs not disposed of, but he cannot sell sittings except officially as described.

**Methods of Scoring, Entry Fees, etc.**—The pen section is composed of entries of 6 pullets in each pen, and one competitor can only enter one pen. Any breed or first cross is allowed to compete. All competitors must reside in the administrative county of Nottingham and must certify that they reared the pullets on their own premises.

The pen section is not trap-nested but simply scores on total number and weight of eggs produced. The margin of error is negligible, as eggs laid on the dropping board, in the litter or in the run are recorded. Shell-less eggs as well as double-yolked or very small ones all go into the score. If an egg is fit to eat it is fit to be added to the score. Small eggs are handicapped not by being ruled out altogether, but by having a much lower total weight. Weight, not number, counts in the final score, and it has happened that the sixth pen actually laid more eggs than the second pen.

In the single pullet section (heavy and light breeds) all pullets are trap-nested and the records are of course not so accurate owing to a very few unrecorded eggs laid in the litter. Scoring in this section is also by total weight.

The entry fees are fairly low so that small poultry farms or private individuals can be represented. £1 per pen of 6 pullets and 4s. per pullet in the single section is within the reach of all. Competitors may send a cockerel to the test in January to mate to their pullets, and can then obtain eggs for hatching as indicated above. A charge of 3d. per week for cockerels is made to cover food costs.

It will be seen that the tests demonstrate breeding value and stamina as well as the capacity to lay under adverse conditions. Eggs set from the first position pen in both tests have proved to be of high hatching quality and the chickens have reared well. The manager finds all foods, litter, etc., at his own cost. He also gives the land and labour. The Nottinghamshire Education Committee receives the entry fees and 6d. on each dozen eggs sold for hatching. In the first test about £24 was received by the Committee and in the second test about £36.

**Class of Competitor and Breeds entered.**—In the first test, 1921-22, there were five pens of White Wyandottes, six pens of White Leghorns, three of Rhode Island Reds, two of Black Leghorns, one each of Buff Orpingtons, Croad Langshans, Anconas and Light Sussex. Six competitors run from 250 head of poultry each. Nine run from 100 to 150 head and the remaining five were backyard poultry keepers with up to 40 head. Nine of the competitors were women and eleven were men. The second test, 1922-23, with 26 pens, included nine pens of White Wyandottes, eight pens of White Leghorns, three of Rhode Island Reds, two of Light Sussex, one each of Black Leghorns, Buff Orpingtons, Sicilian Buttercups and a first-cross Wyandotte-Rhode Island Red. The competitors were owners



of flocks of approximately 200 head, except one egg farm and four backyard poultry keepers. Seven of the 26 competitors were women.

**Result of the Tests.**—The total number of pullets competing in the first test (1921-22) was 120, and the egg yield from 1st November to 30th April, was 12,394. The average per pullet was 103 and the deaths amounted to three. In the second test (1922-23), there were 193 pullets. The total egg yield was 15,514 eggs. As the second test started on 1st October, 1922, instead of on 1st November as in the previous year, the average per pullet is less,—October, a lower production month, being included, and April, a high production month, being excluded. The average per pullet was 82 eggs. The deaths amounted to seven, but two of these were killed by either a fox or a dog breaking into a pen. The tests have both been quite free from infectious disease, all deaths from disease being caused by ovary trouble.

Considerable numbers of eggs were taken from the mated pens by the owners for incubation, and the hatching results in most cases were excellent. The sales of eggs to outside poultry keepers were small owing to the price charged for eggs from the leading pens being high for most people. The idea that it is not advisable to breed from high production pullets, which is generally accepted, has been disproved by the reports of high hatchability and high rearing results. In one case fifty-three chicks hatched out of sixty eggs from the leading pen and almost all were reared.

**Comparison of Breeds in both Tests.**—Rhode Island Reds won the first test with 766 eggs weighing 96 lb. 6 oz. This gives an average per pullet of 127 eggs. White Leghorns won the second winter's test with 649 eggs weighing 77 lb. 15½ oz. The average per pullet was 108 eggs. By comparing the results of the leading pen in both tests for November, December and January (12 weeks) we get the following:—1st Test, Rhode Island Reds, 362 eggs. 2nd Test, White Leghorns, 308 eggs.

**Prizes.**—Three silver medals and four bronze medals, and certificates of merit, are awarded to the best pens.

**Cost of Feeding.**—The cost to feed each pullet works out at 2¾d. per week. The mash cost 15s. 6d. per cwt. and the grain 11s. per cwt., and 1 lb. of each is consumed per week. The high production pens take more, but in others very little is eaten when partial moult, broodiness, or resting is going on.

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## SECURITY OF TENURE FOR ALLOTMENT HOLDERS.

E. LAWRENCE MITCHELL,

*Ministry of Agriculture and Fisheries.*

THE article which appeared in the August issue of this *Journal*, entitled "Permanent Allotments : Security of Tenure and How to Obtain It," was of considerable interest in drawing attention to a subject which is arousing a great amount of discussion among allotment holders at the present time. The problem of security of tenure is a burning question with those who cultivate allotments in their spare time. The Report of the Departmental Committee on Allotments, 1922, contains the following passage :—"The evidence we have received from the representatives of the allotment holders has been unanimous as indicating a keen desire for security of tenure. It is obvious that the cultivators of allotments will be more likely to make greater use of their land and much better cultivation and increased production will result if security of tenure is made possible. In order that such security may be given, however, it is necessary that land should be purchased by the Local Authority or by an Allotments Association."

In order to meet the situation, the Committee recommended that local authorities should purchase land for allotments wherever practicable within, or on the outskirts of the towns, and that co-operative allotment associations should be empowered to obtain loans for the purchase of land from the Public Works Loan Commissioners.

As regards the first of these recommendations a condition militating against its adoption is the fact (in the words of the Committee's Report) that "in the large cities and towns it is probable that the capital value of land within reasonable access of the homes of persons who desire to cultivate allotments, is so high as to prevent the purchase of land by Local Authorities, if a condition precedent to the acquisition is the payment of economic rents by the plot holders." Under existing legislation, a local authority is required to make its allotments undertaking self-supporting, except that expenses of acquisition, of making public roads, and sinking fund charges in respect of loans raised in connection with the purchase of land need not be taken into account. It is, of course, true that if land is purchased at a high figure, the rent which the local authority will be obliged to charge to the plot holders will be correspondingly high, but it



is a matter for careful consideration by the allotment holders themselves whether a higher rent is not more than justified in consideration of the advantages which accrue to the plot holders in obtaining security of tenure.

**Hiring versus Purchase.**—To illustrate the point, let it be supposed that an urban authority are faced with two alternatives : (1) *hiring* for allotment gardens land with a present, or prospective building value, or (2) *purchasing outright*. Under the terms of hiring, the owner would doubtless be entitled to re-enter and end the local authority's tenancy at any time after three months previous notice in writing if the land were required for building, mining or other industrial purposes, or for roads or sewers necessary in connection with any of those purposes. The allotment holders would therefore be liable to be turned off their plots at any time during the year after three months notice, although it is true they would be entitled to compensation for the crops growing on the land in the ordinary course of cultivation of the land as allotments and for manure applied to the land. The rent payable by the local authority to the landlord might be anything from £3 to £8 an acre, the higher figure being payable where the land had an accommodation value owing to its proximity to a large city or town. Assuming that the rent were fixed at £8 an acre and the local authority added say 10 per cent. for administrative expenses, management, bad debts, unlet plots, etc., the rent payable by the allotment holders would be £8 16s. an acre. Each acre may be expected to provide 15 plots of 10 rods each, after making allowance for paths, and the rent of a 10-rod allotment would therefore work out at approximately 12s. per annum.

As an alternative to hiring, let it be supposed that the local authority could purchase the land outright for £300 per acre. A loan could in all probability be obtained from the Public Works Loan Commissioners in respect of the purchase money, the repayment to be spread over a period of 80 years, the rate of interest current at the present time (October, 1923), being  $4\frac{3}{4}$  per cent. The loan charges in respect of a loan of £300 would be £14 11s. 10d. per annum, including repayment of principal, and adding the same amount for administration as in the case of hiring, namely, 16s. per acre, the rent which the local authority would have to charge to the plot holders excluding repayment of principal would be approximately £15 per acre or £1 per plot of 10 rods—a difference of only 8s. per annum per plot as compared with the 12s. rent if the land were hired.

The point for consideration by plot holders generally, is whether the fact that security of tenure could be obtained by the payment of an additional rent of 8s. per plot annually, would not justify a large extension of the provision of allotments on a permanent basis by means of purchase of the land by a local authority. There seems considerable force in the contention that the advantages which the plot holder would enjoy under conditions which would enable him to feel absolutely secure in his tenancy so long as he paid his rent and cultivated his plot properly, are well worth the additional annual payment.

It should be remembered in this connection that the amount of rent payable by a plot holder for his allotment is, after all, the smallest contribution he makes towards the cost of producing his crops. The purchase of seeds and manures, is, of course, an important consideration, but the really heavy item to be considered in the production of crops on an allotment is the allotment holder's labour. This labour is, however, given in his spare time, and is really a recreation, and is labour for which he has no market. It is submitted that the value of the crops produced from a 10-rod allotment under normal conditions and with an ordinary amount of skill on the part of the cultivator is such that a payment of 8s. per annum in the nature of rent is really a very small item. Under the system where the plot holder has security of tenure he can cultivate his plot without risk of disturbance; he is encouraged to plant crops, fruit bushes, trees, etc., which continue productive for more than one year; he is more likely to erect a permanent and attractive shed for his tools, etc., and in all probability to beautify his allotment with the addition of a few flowers which, without reducing materially the food productivity of his plot would make it more attractive as a feature of the landscape.

It may be explained that in comparing the two alternatives of purchasing or hiring land for allotments, the cost of erecting any necessary fencing, providing water supply, making paths, and such items, may be disregarded, as such expenditure will be common to either scheme: but where land is purchased with resulting security of tenure for the allotment holders, it is obvious that there is wider scope for the carrying out of more or less permanent improvements, and a certainty that the allotment holders will reap the full reward of any such expenditure.

**Loans to Associations.**—With regard to the second recommendation made by the Departmental Committee as to loans being granted by the Public Works Loan Commissioners to



Co-operative Allotment Associations, it was not considered practical for effect to be given to the recommendations in the recent Allotments Act of 1922 for the reason that money was not available for the purpose at the time of the passing of the Act. In view of this it is desirable to consider whether loans from the State *direct* to a society are a necessary corollary to the purchase of land for allotments by such associations. A particular case, as described in the article in the August issue of this *Journal*, would appear to indicate that direct loans by the State are not essential where the instinct of co-operative self-help is already sufficiently developed amongst the members of an allotment association, and particulars of other cases, which are given below, of societies which have actually arranged the purchase of land for allotments, appear to indicate that given the necessary ability and energy on the part of the plot holders and the officers of an association, there is no reason why a considerable extension of the purchase movement should not take place.

**Warley Freeholders, Limited.**—In the Warley district, on the outskirts of Birmingham and lying between Oldbury and Smethwick, about 12½ acres of land had been provided for allotments by the local authority under the Defence of the Realm Regulations. The tenants realised, however, that as the land had been provided under emergency war legislation there could be no security of tenure, and in 1919 they approached the local authority and asked them to purchase the land so that it could be let under more permanent conditions. The local authority could not see their way to purchase the land and the tenants then approached the owners direct with the result that the land with three cottages was offered to them for £2,700. It was decided to accept this offer and the allotment holders formed themselves into the Warley Freeholders, Limited, a Society registered under the Industrial and Provident Societies Act and affiliated to the Agricultural Organisation Society, the Secretary of the Society being Mr. R. C. Woodward. One of the members, Mr. J. E. Taylor, lent the Society all the purchase money at 4 per cent. interest free of income tax, and it is doubtful whether the scheme could have been carried through without an advance on such favourable terms. Each member was required to become a shareholder and pay at least £5, following this with periodical payments until he held shares to the value of the plot he wished to purchase. A call on the members resulted in a payment of £537 15s. by the 31st May, 1919. This enabled matters to proceed. The next step was to get the balance of the borrowed money from the members. They paid as much as they were able on the pay nights, the minimum being 10s. every four weeks. By the 30th September, 1920, no less than £1,000 had been paid off, and a year later on the same date this had been increased by £490. At the annual meeting the members decided to inaugurate a "mutual scheme" to endeavour to finish the matter as owing to unemployment and other causes a few members were transferring their shares.

The plan arranged was that the front portion of the land should be sold for building purposes and that the cottages also should be sold. The rear

portion of the land, about 8 acres, was sold as allotments to member shareholders of the society and only eight shareholders were repaid their share capital in lieu of taking up land, the remaining 90 members allowing their money, which they had already paid in, to remain as payment for land allotted to them. The scheme was a financial success and after all expenses had been paid, interest at the rate of 5 per cent., amounting in all to £202 8s. 9d., was paid on share capital from the start and a surplus of £329 7s. 6d. was returned to the shareholders at the rate of £3 17s. 6d. for each full share. The late shareholders own the plots on condition that no houses shall be erected and that the ground remains as allotments. By co-operative methods security of tenure has been obtained and an open space under garden cultivation has been permanently secured.

**Witton and District Allotments, Limited.**—A further example is that of the Witton and District Allotments, Limited. In this case an area of land comprising  $80\frac{1}{2}$  acres was under cultivation as allotments by the society when it was purchased by Farrow's Bank. It was valued in the Bank's assets at £25,000, but when the Bank went into liquidation the society was successful in purchasing from the Official Receiver for £7,000. The society, which was duly registered and affiliated to the Agricultural Organisation Society, purchased, in addition to the land, a farm house and farm buildings for the sum of £1,500. Possession of the house has not yet been obtained, but the farm buildings have been utilised for the purpose of a social club, the farm yard being converted into a bowling green; the barn into a lecture and concert room; the cowshed into a games room with a billiard table, and the cartshed into a refreshment room, ladies room and office.

There are some 800 plot holders and a further 100 persons are members only of the social club. Each plot holder pays a membership subscription of 2s. 6d. plus 8d. for a card annually, together with 10s. rent for his plot, averaging 300 sq. yd. Social members pay 1s. per quarter. The society were fortunate in raising £6,000 from a Bank at 5 per cent. interest. Each plot holder is required to take at least one £1 share, but it is expected that each should become a shareholder to the value of £5, shares being payable by instalments if desired, the maximum amount which any member may invest in the society being £200. It is hoped that the borrowed money will be paid off in two years. An effort is being made to raise 1s. per member per week during this period, and it is anticipated that this, with the profits of the club (which is fully licensed and which has a turnover of £100 per week), will produce the necessary money in that time. Another source of income will be the selling of the frontage land in building plots.

**Kidderminster.**—Another example may be quoted of land at Chester Road, Kidderminster. In this case 12 acres of land were purchased for £2,350, and after allowing for cartways was divided into about 90 plots of 600 sq. yd. each. The price fixed for the plots varied from 2s. per sq. yd. for building land adjoining the roadway down to 7d. per sq. yd. for the back land. In order to obtain ready money, purchasers of the building plots were required to pay a deposit of £10 and others £5, the balance to be paid off at the rate of £1 per month. A society, known as the Chester Road Land Society, was formed. The first meeting for the paying of instalments was held in



October, 1920, when no less than £609 was paid in by the members. The men took possession of their plots on 1st November of that year, and by 31st December another £600 had been collected, the remainder of the purchase money being borrowed from the Bank. By February, 1923, only six members out of about 80 had not completed payments, and there was a balance at the Bank. Water has been laid on at a cost of £125, and this expense and upkeep of roadways, etc., has been paid off. The building plots have already appreciated in value. Mr. A. H. Weavers, of Kidderminster, who was mainly responsible for the original scheme, has carried out a similar scheme at Offmore Lane, where 42 plots of approximately 600 sq. yd. each have been purchased by the members of the Offmore Land Society.

**Beckenham Allotments.**—Another instance is the Beckenham and District Allotments Society, Limited, who purchased in 1921 some 2 acres of land at a cost of £92 10s. per acre, including all legal expenses. This land has been cut up into 30 10-rod plots, a standard rent of 1s. per rod being charged, bringing in £15 per year, out of which the society pay £5 for road and upkeep, leaving approximately about £10 per annum for the repayment of loans, which it is expected will be paid off in 19 years. Each member taking up a plot is required to lend to the society a minimum of £1 and maximum of £5, free of interest, repayable at three months notice.

**North Mitcham Allotments.**—Another instance of co-operation in practice is afforded by the North Mitcham Improvement Association's scheme. The main feature of the scheme is that while there was co-operative bargaining without liability, when agreement was reached as to details it was possible to secure individual payment and contract. From a local landowner a verbal option was secured on 7 acres of "back" land which had been used for allotments during the war and was not convenient for sports purposes. With the aid of the general fund of the new local association, a meeting was advertised for the purpose of discussing the scheme, and the support was sufficient to allow the acceptance of names of prospective purchasers. A local surveyor voluntarily prepared a plan which allowed for 92 10-rod plots with 10 ft. roads for approaching each. The price per plot was £20, with £5 to provide for roads and fencing, and restrictions were placed on building. The landowner agreed to accept £1,840 for the land and to take payment by instalments from 60 per cent. of the purchasers, the vendor's solicitors collecting the purchase price of each plot, whether paid in one sum or by instalments, and also the £5 per plot for development, in respect of which they acted as bankers. The solicitors on both sides charged merely nominal fees. The roads were vested in trustees appointed by the plot owners. The advantages of the scheme of permanent allotments are evident; the effects of ownership are seen in the succession of first-rate crops which have since been grown.

It will be seen from the particulars given above that there is a wide scope for variety in the details of schemes for the purchase of land for allotments, and the circumstances of any particular case may bring forth difficulties which will have to be overcome. On the other hand, experience may prove that in other cases difficulties will be less. For instance, it may be found that

owners of land will be agreeable, when selling land to allotment associations, to allow a considerable proportion of the purchase money to remain on mortgage, thus reducing the amount of capital to be provided, in the first instance, by the members of the association. Moreover, where part of the land purchased has an immediate building value, the selling off of the frontage land makes the retention of the remainder of the allotments an easier financial proposition. Similarly, in the acquisition of land, part of which has a potential building value, the scheme might partake of the nature of a building development scheme hand in hand with the provision of allotments on the back land. In any such case, the important point which has to be borne in mind is that the main object of the scheme, namely the provision of allotments to be utilised as such on a permanent basis, can only be achieved if conditions are imposed laying down clearly that the land shall remain under allotments in perpetuity; and where an association sells plots on the "allotment" portion to its members it seems desirable that restrictions should be imposed as regards building, as otherwise the main object of the scheme might be defeated.

It may be stated as an axiom that co-operative effort on the part of either an association or individuals, both in the direction of forming an association and carrying on the administrative work, the provision of labour for erecting fences, making paths, etc., is essential if the cost of the scheme is to be kept within reasonable limits. In the past, would-be plot holders have usually looked to the local authority to do practically all the work, whether in regard to provision of land, or administration, equipment, etc. The cost of all such work, however, has had to be recovered from the allotment holders in the form of rent, with the result that complaints have been made of the high rents charged. But with co-operative effort on the part of all concerned—the local authorities, allotment associations, and individual allotment holders—there seems no reason why the purchase of land for allotments with the resulting security of tenure should not be largely extended.

The writer is indebted to Mr. R. C. Woodward for information as to Warley Freeholders, Ltd., to Mr. Albert H. Weavers as to the Kidderminster schemes, and to Mr. A. W. Burgess as to the North Mitcham Improvement Association, Ltd.



## YOUNG FARMERS' CLUBS.

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**Origin.**—The Young Farmers' Clubs movement had its origin in America, and Farmers' Bulletin No. 385, issued in 1910 by the U.S.A. Department of Agriculture, suggests that it began, under the auspices of the College of Agriculture of Cornell University, as a development from nature-study lessons. By 1910 the Cornell Farm Boys' and Girls' Clubs had an aggregate membership of about 75,000, and the Cornell Rural School Leaflet, through which the movement was largely directed, was distributed to about 7,000 teachers and school commissioners. Similar progress was made in other States, and in 1912 the Federal Department of Agriculture supplemented State aid by a grant of 4,600 dollars. Federal financial support has not only been maintained, but steadily increased and reached, in round figures, 105,000 dollars in the year 1920-21.

The necessity for increased food production stimulated this movement during the War, and at the present time the development of Boys' and Girls' Agricultural Clubs forms an important part of what is known as "Co-operative Extension Work in Agriculture and Home Economics" in the United States. The U.S.A. Department of Agriculture and the 33 State Colleges of Agriculture co-operate in this work, which is carried on through a very complete county organisation, including provision for the furtherance of the club system. This form of practical agricultural education for young people is therefore part of a larger whole, and boys and girls appear to be participating increasingly with adults in carrying out common programmes of work. The fact that in 1920 5,043 standard clubs existed in the U.S.A., and that over 3,000 "Community programmes" (embodying special farm and home interests of men and women, boys and girls in a given locality) were developed, shows the extent to which the agricultural pursuits of the present and the rising generation have already been identified. More than 700,000 children are now enrolled in these clubs, and some idea of their activity may be gained from the fact that during the War they produced food to the value of no less than 20,000,000 dollars in a year.

Young Farmers' Clubs were instituted, on similar lines, in Canada in 1913. At the present time there are over 35,000 club

members in the Province of Manitoba alone, and considerable developments are reported in Alberta, Saskatchewan, Ontario and British Columbia.

**Development in England.**—The first Young Farmers' Club in this country was founded in 1921 at Hemyock, Devon, by the United Dairies, Ltd., the objects in view being the production of cleaner milk and the introduction of a heavier milking breed into the district. The fact that the club now numbers 150 Associate Members amongst local farmers, that four of the members have attended courses at Seale-Hayne College, and that other clubs are to be established, is some indication of the nature of the influence exerted on farming methods in the neighbourhood. There are now 37 clubs in England and Wales, with a membership of over 600, and there is every likelihood of considerable expansion in the near future. The existing undertakings include the rearing of calves, pigs, poultry and rabbits, bee-keeping and horticultural production. The movement in England has been carried on under the ægis of the *Daily Mail*, which was also responsible for the formation, in 1921, of the International Federation of Young Farmers' Clubs, by means of which English, Canadian and American clubs have been brought into close touch. American young farmers have visited this country, and, as a result of the enterprise of the *Daily Mail* and the generosity of the Canadian railways, 4 boys and 4 girls, selected from Young Farmers' Clubs over here by representatives of the Board of Education, Ministry of Agriculture and the National Farmers' Union, have enjoyed an educational holiday in Canada this summer. The International Federation of Young Farmers' Clubs has received inquiries from Argentina, Africa, Australia, Holland, Sweden and Russia, and interest in the movement is evidently world-wide.

**Purpose, Value and Possibilities.**—The primary object of the movement is improvement in the quality and quantity of foodstuffs, but it is certain that other important results are also secured. Club membership constitutes a most effective training not only in farm practice but in business methods and in social intercourse. It is a valuable form of both general and agricultural education, for it tends to evoke and increase intelligent and sympathetic appreciation of every phase of rural life. Young farmers, brought into actual contact with current agricultural problems, and provided with the latest scientific suggestions for their solution, are likely to acquire an abiding interest in the development of the industry on the most approved modern lines.





FIG. 1.—United Dairies, Ltd., Calf Club, Hemyock, January, 1922.  
Members with yearling heifer calves.



FIG. 2.—Doris Fry, United Dairies Calf Club, Hemyock No. 1, with her 1921 heifer  
with calf, her 1922 yearling and her 1923 calf.





That increased demand for entry to agricultural institutions results from the educational stimulus provided by these agricultural clubs has already been demonstrated in England, and this is confirmatory of the experience of the United States. Initiation into business management at an early age is invaluable, and the control of the affairs of the club also provides opportunity for the development and exercise of those qualities which are the foundation of useful and successful public work. Viewed in this way club membership appears as a continuation of education and a preparation for practical affairs.

**Assistance for Young Farmers' Clubs.**—It is evident that the movement is of national importance and that the effects are likely to be as far-reaching as those resulting from such other organisations of the time as the Boy Scouts and Girl Guides. The Scheme has been fortunate enough to enjoy, from the outset, the support of the *Daily Mail*, and it is being increasingly patronised by breed societies and industrial firms. The National Farmers' Union is desirous of establishing close relations with the movement and it has been suggested that members of Young Farmers' Clubs might be enrolled as junior members of the National Farmers' Union branches. Nor is the interest of Government Departments lacking, for the Board of Education and the Ministry of Agriculture are anxious to give every form of encouragement in their power. The foundation for work of this kind exists in the "rural bias" which the Board of Education encourages in suitable elementary and secondary schools, and of which details are available in the publications of the Board. The practical management of small livestock in connection with the teaching of rural science in elementary schools is an interesting feature. The Ministry, through its Divisional Inspectorate, is able to give much direct assistance, and has promised to use its influence with agricultural training and research institutions with a view to facilitating provision of lectures and dissemination of information. Local Educational Authorities also are becoming increasingly aware of the possibilities of the movement, and are in most cases willing to lend the services of suitable members of their staff. There is every probability that, as in the United States, the connection between schools, local agricultural education and club organisation will become increasingly close. Officers of the Ministry of Agriculture and of the Board of Education may in their discretion do anything consistent with their official responsibilities towards furthering this movement.

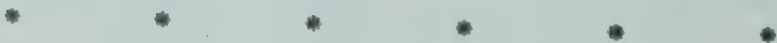
**Formation and Organisation of Clubs.**—Those who are concerned with the furtherance of agricultural education and who may have opportunities of promoting the establishment of Young Farmers' Clubs in suitable localities will be interested in the procedure which has been followed hitherto.

A decision having been arrived at as to the kind of produce or stock which can be dealt with most suitably in the neighbourhood, a patron is secured, who will bear the initial expenses, and a small advisory committee of experienced and energetic helpers is set up. This Committee invites the young people of the neighbourhood and their parents to a meeting at which the project is outlined and club management explained. From ten to twenty of the children present (ranging between 10 and 18 years of age) then form themselves into a club, which chooses its own officers and regulates its own affairs.

With the fund supplied by the patron, or founder of the club, stock is purchased, judged and allotted by ballot to the members—a note of hand, signed by the member and backed by the parents being taken in exchange. At the end of a stated period (varying with the nature of the stock), during which inspections are made by the advisory committee, the stock is re-judged and prizes given for progress made and records kept. The animals are subsequently auctioned, the amount of original value repaid to the patron and the balance handed to the member concerned. Slight variations from this plan obtain in the case of, *e.g.*, crop-raising clubs, but detailed information is obtainable from the Secretary, Young Farmers' Clubs, the *Daily Mail*.

At the weekly or fortnightly meetings of the club, lectures are given or discussions held. Associate Members, who have no voting power and for whom there is no age limit, are entitled to attend these meetings.

With the continued growth of the movement variations of existing methods of instituting and maintaining the clubs will suggest themselves. The establishment of contact with other rural organisations will open up new possibilities. The sympathy of country women for instance might be secured through the Women's Institutes, and the interest of officials of agricultural societies would assist in bringing the whole scheme more prominently to general notice in the showyard and elsewhere. The movement is certainly well founded already, but deserves even wider public recognition than it enjoys at present.





## BLACK AND RED CURRANTS.

**BLACK CURRANTS.\***—In consequence of the losses caused by big bud, running off, and reversion, large areas of black currants have been grubbed and replanted to other crops, so that the present home production falls short of the demand, and good market prices prevail for the fruit. Though these troubles are of a serious nature, it is possible to produce satisfactory crops by planting none but true and healthy stocks of varieties suitable to the soil and district, and by exercising special care in controlling the spread of big bud and reversion, and in carrying out suitable cultural and pruning operations, which, with the aid of sufficient and suitable manures, will encourage the bushes to develop strong and healthy new shoots annually. The size of crop produced is largely influenced by the character of the soil and other conditions, and by the care and treatment given to the plants. The weight per acre may vary from 7 cwt. to 2 tons, or even more where conditions have been extremely favourable. Where experiments have been carried out the records show, however, that the crop generally averages under 1 ton to the acre. For instance, Dyer and Shrivell, in their experiments at Tonbridge for eight seasons, obtained crops varying from 15 cwt. per acre where 25 tons of London dung were used as manure, to 7 cwt. per acre where only phosphates and nitrate of soda were used. At East Malling during 1917, 1918 and 1919 the records indicate that an acre of "French" (1,210 bushes to the acre) might be expected to yield a crop varying from 17.4 cwt. to 4 cwt. Similarly, "Boskoop Giant" varied from 16 cwt. to 6 cwt.; "Victoria" from 14 cwt. to 4 cwt. and "Baldwin" from 26.8 cwt. to 18.8 cwt., according to the manurial treatment adopted. It appears that within each variety there exist strains of high productivity.

**Propagation.**—It is evident, therefore, that trials are necessary to ascertain the varieties which are best suited to the local conditions, after which further developments may be made by planting purchased bushes or bushes which can be propagated at home from cuttings. Before purchasing it should

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\* See also Black Currant Growing in Norfolk, by H. Goude; this *Journal*, April, 1923, p. 62.

be ascertained that the bushes are true to name, free from rogues, big bud disease and reversion. The bushes may, however, be propagated at home from cuttings (*i.e.*, vigorous, well-matured young shoots, 10 in. in length) taken from bushes; but it is of the greatest importance that the cuttings be taken only from bushes known to be free from big bud disease and reversion.

Cuttings should be taken in October or November. They should be of substantial thickness and about 10 in. long with all the buds on, so that the bushes are not grown on a leg. The best growth is made if cuttings are planted on the same day that they are cut off the parent bush. The ground should be well prepared for planting and the cuttings should be put in 6 in. apart in rows  $2\frac{1}{4}$  ft. apart against the side of a furrow or notch at a depth that permits two or three buds to project above the soil level. The soil is returned—on stiff soils not more than 2 in. at a time—and carefully trodden down. During the following spring and summer the surface of the soil should be kept moved to conserve moisture, and prevent the growth of weeds. The bushes should be fit to plant out at one year old.

A description of a method adopted in Norfolk for raising clean plants from spring cuttings was fully described in the August, 1921, issue of this *Journal*, p. 460.

**Planting.**—Black currants grow satisfactorily in varied types of soils, ranging from heavy loams to light sand, always providing that the texture permits of free rooting and that an adequate supply of moisture can be obtained. The site of the land should be both warm and sheltered, under which conditions insect life is more abundant and pollination facilitated. This is particularly important in the case of those varieties bearing flowers with the stigma projecting beyond the anthers, for in this case many of the flowers fail to become fertilised by natural processes, and there is a consequent poor set.

Before planting, the land should be well manured, and cultivated to a depth of at least 12 in. (deeper if there is a hard pan below). In practice this is preferably done for the previous crop, though further deep cultivation should be given to bring the land into a suitable condition for planting. The bushes are usually planted at 6 ft. square, though Baldwin varieties may be only from 4 ft. to 5 ft. apart. In some districts it is believed that better results can be obtained by planting bushes very much closer together.



The planting should take place preferably during the autumn, though it can be done in January and February. At the time of planting, or soon after, all growth should be cut to within two buds of the base.

**Cultivation and Manuring.**—After planting the land must be kept clean, free from weeds, and in a loose friable condition at the surface. In practice this is accomplished by shallow digging or ploughing up to the bushes in the winter, followed by spring and summer cultivation.

Near the bushes the digging, ploughing and cultivation should be shallow to avoid harm being done to the masses of fibrous roots.

Whilst black currants benefit from repeated applications of manure, experiments by Dyer and Shrivell, and by Hatton at East Malling, indicate that the crop is not equally responsive to all classes of manure. Farmyard manure appears the most suitable and liberal supplies of this should be given. Fish, meat and bone meal and shoddy are often used in both Kent and Norfolk in conjunction with smaller supplies of farmyard manure. The crop does not, however, seem always to respond to dressings of artificial manures. Summer mulches with farmyard manure, reeds, or spent hops prove beneficial.

**Pruning.**—In the winter following the planting, all the bushes that have made three or more growths at least 2 ft. long should have the weakest shoots cut back to two buds. All the shoots of the less vigorous bushes should be cut back to two buds at the base.

In later years, with older bushes, the shoots are not shortened but the bush thinned by removing the less vigorous branches each year. This encourages the development of new shoots, on which the black currant fruits best.

Though not properly forming a part of pruning operations, it is essential that the measures for the control of the big bud mite\* should be carefully observed. Branches which show reversion† must be cut out, and in some cases whole bushes grubbed.

**Varieties.**—In a short article it is only possible to deal with such varieties as are commonly grown for market. The characters most useful for determining black currants are possibly the habit of growth of the bush, and the colour and shape of the buds and bud scales, which characters are more apparent during the winter months. There are other points of importance that help

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\* See Leaflet No. 1 (*Black Currant Mite*).

† See Leaflet No. 377 (*Reversion or "Nettlehead" of Black Currants*).

to distinguish one variety from another, such as :—The period of breaking into leaf—early with Baldwin and late with Boskoop; the size of the leaf as a whole; the shape of the central and lateral lobes; the depth of indentation where the lobes meet, and the indentation at the base by the leaf stalk; the leaf serration. The blossoms have individual points of difference; the length of each raceme (chain) varies from “long” in the case of Boskoop to “short” in the Victoria group. Boskoop frequently has single racemes springing from a spur, whereas three to six are common in the Victoria group. The fruit, which is of most importance to the grower, exhibits certain differences in size, flavour, and skin toughness, and these will be considered, but generally these distinctions are less dependable than those of the bush, leaf, and blossom.

The descriptions of the varieties are as follows :—

GROUP I.—FRENCH TYPE.—Bush and Leaves.—Very large, much branched bush, very compact. Moderately strong and quick grower. The buds are pink to deep red in colour, of medium size, conical shape, pointed at the apex, and somewhat tightly wrapped with bud scales. The leaves are of medium size and are pointed, *i.e.*, the lobes end acutely, the serrations of the lobes are acute, and the indentation between the central and lateral lobes is deep. The base of the leaf, on the contrary, is fairly level.

Blossom and Fruit.—One to three racemes (blossom chains) spring from a fruiting spur, each bearing from six to ten individual flowers, so that the raceme is of but medium length. The stigma (the female part of the flower) is frequently above the anthers (the male part carrying the pollen). Not all the flowers set fruit, so the trusses are short, and fruit medium sized; ripens in mid-season, very acid. The berries have a tough skin and travel well.

This variety under most conditions appears resistant to big bud, but often shows reversion.

Merveille de la Gironde, North Holland Black, Resister, Ogden's Blue, Lee's Prolific, Black Naples, Seabrook Black, Mammoth, and Westwick are varieties belonging to this group.

GROUP II.—BOSKOOP GIANT TYPE.—Bush and Leaves.—A sturdy, spreading and rather scantily branched bush of medium size. The buds are large, broad and blunt, pink to purple in colour. These buds give rise, early in the season, to large flat leaves less angular than French, and held at right angles from the stalk. The lobes are broader, and end less acutely; the serrations generally are crenate. The base of the leaf is deep, indented by the leaf stalk.

Blossom and Fruit.—The fruit spur, late in the season, frequently develops but one raceme (blossom chain), but this a long one containing from twelve to nineteen large flowers, with the stigma projecting above the anthers. The trusses of fruit are long, though many of the bottom trusses fail to set their fruit, and running-off is considerable. This type is the earliest to ripen its berries, which are moderately sweet, and provided with tender skins. To carry well, marketing should be done before the fruit is ripe. Other varieties of this group are Hoogendyk's Seedling, Prince of Wales, and Black Bunch.



GROUP III.—VICTORIA TYPE.—Bush and Leaves.—The bushes are of medium size, very erect, and the branches a very light buff colour and often forked. The buds are small, somewhat crowded, conical in shape and pointed, and of a very light green (almost white) colour; the scales are loosely arranged around the buds. The variety comes early into leaf, and the leaves are small. The lobes are irregular in shape; the terminal tending to be tri-lobed; the laterals are irregular in outline; the indentation at the meeting of the lobes is often very deep; but the base of the leaf is fairly level, or with but a shallow indentation by the stem.

Blossom and Fruit.—Usually three to six racemes (blossom chains) develop from each fruiting spur; each raceme has from eight to eleven single small flowers. In this variety many of the stigmas (female portion) are slightly above the anthers. There is some running-off in this variety, but it is not extensive. The trusses are short and crowded together; the berries ripen in mid-season, they are large, sweet, and have moderately thin skins.

Goliath, Edina, Monarch and Bang Up are well-known varieties of this group.

GROUP IV.—BALDWIN TYPE.—Bush and Leaves.—The least vigorous of all the cultivated black currants, making a dwarf though compact bush. The light green coloured buds are large and long, conical in shape, and pointed. The scales are very loose and ragged. The variety is the earliest to develop leaves; these are small and very regular. The central lobe is somewhat long, and ends acutely, which tends to give the leaf a long appearance. The indentation at the base of the leaf is very deep.

Blossoms and Fruit.—From each fruiting spur two or three racemes (blossom chains) usually develop each containing from six to twelve individual flowers, in which the stigmas (female part) are generally on a level with the anthers (male part); this apparently facilitates pollination, for little "running off" occurs and the fruit sets well. The berries are of medium size, ripening late in the season, somewhat acid, and with tough skins which allow the fruit to be marketed even when fully ripe.

Emsden Defiance and Bodenburg's Black Prince are varieties of this group.

**RED CURRANTS.**—The demand for this fruit is more limited, and the market is at times over-supplied. The crops are easily grown, and, where good cultivation is adopted, heavy and regular crops can be secured. The bushes are propagated from cuttings taken and planted in a similar manner to that described for black currants, though all except the three or four buds at the top of the cutting should be removed; the bushes then will remain free from suckers.

Red currants flourish best in the lighter soils, and can be grown successfully under top fruit.

*Planting and Manuring.*—The bushes should be set less deep than is recommended for black currants, and the distance for planting is 5 ft. square.

The bushes require less organic manure than black currants. In addition this crop is favourably influenced by artificial

fertilisers, such as potash salts given in conjunction with phosphates and nitrate of soda.

**Pruning.**—The red currant bush should be cut in quite a different manner to that described for black currants. The red currant bears chiefly on the fruiting spurs formed on the older wood. The aim should be to produce a bush of six or seven principal branches evenly arranged so as to form an open basin to facilitate the ripening of the fruit. Two or three hard prunings should be sufficient to obtain this. Subsequent prunings merely amount to cutting the main branches back to an outside bud to leave about 6 in. of the currant growth each year. All laterals should be cut back close to the fruit buds at the base. The summer pruning of all laterals to about 4 in. before the fruit is picked usually proves advantageous.

**Varieties.**—In the breeding of the cultivated red currant three distinct species have been used (*Ribes rubrum*, *R. vulgare*, *R. petraeum*), and as would be expected the characters of each of these species appear in varying degrees in most of the present varieties. Thus it is convenient to classify the varieties into groups according as their botanical characters show a strong resemblance to these three species.

Certain well known varieties are selected as types.

I. *The Rubrum Group.*—Varieties placed in this group have pitcher-shaped flowers, held stiffly out on wiry stems. Varieties of the Raby Castle type also have downy leaves—which is not so with the Scotch type.

(a) **RABY CASTLE TYPE.**—*Raby Castle.*—Bush and Leaves.—A medium sized bush, upright, with broad light yellowish-green leaves, very hairy on the underside.

Blossom and Fruit.—The blossom-truss, which appears before the leaves, is of medium length, bearing a number of pitcher-shaped, green flowers, without fleshy ring round pistil. The fruit is carried on stems (pedicels). The berries are of medium size and of a bright red colour, which is maintained on ripening. A fertile late-season variety.

*Houghton Castle* (synonym New Red Dutch).—This variety is often mistaken for Raby Castle, from which it differs by having silvery foliage. The bunches are longer, the fruit stems long, and on ripening the berries turn darker to a dull, red colour.

(b) **THE SCOTCH TYPE.**—*Scotch* (synonyms London Market, Fowler's London Red).—Bush and Leaves.—A large Bush with upright sturdy branches, bearing large buds (winter stage), and in the summer stage light green small leaves, held horizontally to the stem by stiff wiry stems. Stiffness is the characteristic of this variety.

Blossom and Fruit.—Bell-shaped light green flowers held outwards on a short wiry stem which is somewhat hairy. The berries are close together on



one side of the bunch, which is of medium length, held on a stiff wiry stem (rachis). A prolific early cropping variety of bright red berries suitable for market purposes.

II. *The Vulgare Group*.—This section contains those varieties with characteristics indicating their descent from *R. vulgare*. The flowers are very open, almost flat, and show a distinct fleshy ring round the pistil. The stems of the flower and fruit racemes are long and thin, so that the trusses hang downwards, with the fruit lying on all sides. The foliage is large and pointed, but thin. The berries are big. Varieties in this group commonly have buds which go blind, and brittle shoots which often snap off when bearing heavy crops, or when exposed to high winds.

(a) *VERSAILLES TYPE*.—*Fay's Prolific* (synonym *Comet*).—Bush and Leaves.—A medium bush, fairly upright, with long pointed buds, and large dark green leaves, not hairy. The tips point downwards. An early variety.

*Versailles* (synonyms *Eclipse*, *Magnum Bonum*).

(b) *THE DUTCH TYPE*.—*Perfection* (Laxton).—Bush and Leaves.—A small bush composed of short branches, with small buds and dark green leaves. A late variety.

III. *Goudouin Group*.—In this group are placed those varieties which exhibit characters indicating their descent from *R. petraeum*. Stout, flat, very large leaves; red shoots; claret-red coloured flowers, raceme long, held stiff, flowers open and bell-shaped, with the outer edges turning outwards rather like the flower of a *Campanula*. Late at starting growth in the spring, and hesitating in shedding its leaves before the winter months. *Goudouin*, *Prince Albert* and *Seedless Red* are varieties of this type.

IV. *Varieties Outside the Groups*.—There are some varieties with mixed characters so that they do not well come into any particular group.

*Victoria* (synonym *Wilson's Long Bunch*).—Bush and Leaves.—The growth is very straggling and uneven; the buds slender and long; the leaves brownish, with leaf stems (petioles) long, middle leaf lobe very pointed.

*Blossom and Fruit*.—The flowers are of the open, flat type, similar to *R. vulgare*, with a fleshy ring around the pistil. The sepals are separated and well apart. The stem (rachis) of the fruit truss is very long and moderately stiff, and the berries separated so that the bunches appear very long. Very late variety.

**Marketing**.—Good samples of early varieties of red currants are packed in 1 lb. punnets and sold to be mixed with raspberries for dessert. Black and red currants are also marketed in chip baskets containing 4 lb. and 6 lb. respectively. The bulk of the crop of both red and black are marketed when the berries

are quite firm in strikes of 12 lb. and in bonnets and half sieves containing 24 lb. These packages, which should be lined with clean tissue paper, should contain only sound fruit packed and no leaves. When full the paper should be folded over the top so as to make a neat appearance.

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## THE HEDGEHOG.

H. MORTIMER BATTEN, F.Z.S.

To endeavour to lay down hard and fast rules as concerns the habits of any bird or animal is invariably to invite criticism, for not only do their immediate surroundings influence their ways, but in the world of fur and feather there is just as much individuality as in the world of men. Thus has the wolf cattle-killer been known to acquire a taste for strawberries, thus has the rabbit become wedded to the art of snail-catching, and thus too we have the squirrel which kills song birds. Only one thing is invariable in wild nature, and that is its variability.

This rule, if an order which dispenses with all rules may be termed a rule, applies to the hedgehog as strongly as it does to any beast. Few creatures vary more in their habits than does the urchin of the undergrowth, regarding whom every agriculturist should have some knowledge, for it may be said that the hedgehog is everywhere beneficial to the agriculturist. Game preservation, on the other hand, stands to lose a little if this beast be too abundant, but these points will become evident as we proceed with its history.

A few notes from my own studies will serve to illustrate the variability, or rather the adaptability, of the hedgehog. Some years ago I spent a few months on an estate in Dorsetshire where hedgehogs were abundant. In that locality the undergrowth was dense and prolific, and the hedgerows grew rank, with the result that the hedgehogs were surrounded by an abundance of their natural insect fare. So the gamekeepers had no quarrel with them, and I have seen a whole family of hedgehogs meandering about the keeper's garden paths at sundown. The man informed me that he had never found them guilty of egg stealing, the crime for which the animal is chiefly condemned, while he recognised the fact that such assiduous insect hunters were beneficial to his borders. Incidentally I might mention that a pied wagtail brought off her brood in a rockery about which the urchins were regularly to be seen.



My next study of the species takes us to a bleak and rocky limestone valley in the north of England. There was very little heavy timber in this valley, though the abundance of hazel bush and silver birch along the stream edge had long afforded shelter for several prosperous families of urchins.

Here, naturally, there was little insect fare, with the result that the hedgehogs had to look in other quarters for a living, and it soon became evident that they depended mainly upon the rabbits. The rabbit catcher told me that they were the worst snare robbers with which he had to contend, and if, when ferreting, we were compelled to dig, we almost as often as not unearthed a hedgehog from the burrow. Evidently they claimed free usage of the warrens, retiring there to sleep away the daylight hours.

So far as the free and adult rabbits are concerned the hedgehog is, of course, helpless, but in this locality the animals had acquired the habit of hunting out the nesting "stops," in which the newly-born rabbits lay at the end of the narrow shaft. Often these breeding burrows are so small that one would think a hedgehog could hardly squeeze into them, but he appears to have no difficulty in that way, and once he is inside the young rabbits are doomed. The hedgehog may remain in the same stop two or three days till the meal is consumed, when he moves out in search of the next. Regularly we found the animals walking about with their coats thickly matted with rabbit nesting materials, which was certainly strong enough evidence as to their habits. In many parts of the Highlands I have found the hedgehogs addicted in just the same way to rabbit hunting, which, so far as agriculture is concerned, is perhaps another point in their favour.

This beast, like every other, follows the lines of least resistance. Where insects are abundant and he need move only a few yards to fill himself on such fare, he does not acquire habits of a destructive kind. Occasional old hedgehogs may stray from the prescribed pathways of virtue, thus bringing destruction upon their race, but if the individual be trapped and killed the mischief will probably cease. If, on the other hand, insects are scarce, the hedgehogs turn to the next most fruitful source of supply. Possibly the abundance of rabbits offers an easy solution, or possibly an abundance of ground-breeding birds results in the hedgehogs of the locality becoming habitual egg and chick thieves.

I have never visited the rabbit-infested areas of Australia, but I should imagine that the hedgehog would find insect fare

none too abundant where the rabbits abound, and I would suggest that a few consignments of hedgehogs might assist the balance of nature as regards a reduction of the wild rabbit's numbers. Where, in the interests of game preservation, such beasts as the hedgehog and the stoat, and such birds as the buzzard have been practically wiped out, farmers are up against the same problem in this country, though of course on a smaller scale, as are their brothers in Australia, where the rabbit was imported without his natural foes.

Kept in an enclosed garden hedgehogs make interesting pets, and very amply pay their way by the number of noxious insects they kill. They quickly become quite tame, allowing themselves to be touched and stroked without erecting their quills, and within two days of its capture a hedgehog will take food—such as a scrap of bacon rind—from the fingers of its captor.

Though the hedgehog cannot be set down as of much value in the destruction of rats, the animal nevertheless takes rank among the natural foes of the rat and his race. I recollect one evening being roused from my work by the sound of a dead thud on the gravel path outside my window, followed by much squealing, and going out I found a hedgehog and a rat engaged in deadly combat. They must have fallen interlocked from the dense creeper above the window, but unfortunately both of them heard my steps and made off, so that I was deprived of witnessing the conclusion of the fight. On another occasion a noise of squealing at the back of some farm buildings took me to the scene, and there I found several rats in the act of mobbing a hedgehog.

It may strike some people as strange that so inactive a beast as the urchin should essay to climb into a creeper, but we need to remember that the hedgehog of the daylight hours is a very different beast from the hedgehog of the night. In the dusk of evening I have seen one of these animals pick himself up and spring off almost as nimbly as a rabbit, and certainly they can climb well. One which was kept in a garden used regularly to climb into the fruit trees and creepers which covered the boundary wall, and it was on a platform of leaves in the creeper, nine feet or so from the ground, that this animal made its winter nest.

**Hibernation.**—The hedgehog hibernates in the true sense. During the autumn months he lays on fat, and when the leaves begin to drift he acquires, accidentally or otherwise, an overcoat of leaves. These become impaled upon his quills, the second



layer ramming the first layer home, and so he goes his way impervious to wind and rain. As the weather turns colder he becomes more and more sluggish, and, no longer a vagrant, he spends much of his time sleeping in some cosy nook abundantly lined with leaves.

I have examined the hibernating quarters of several hedgehogs, and they vary considerably. One I found denned up in a shallow rabbit burrow. The animal was rolled up and thickly entangled in a bed of dry grass, much like a chrysalis in its cocoon, but in addition the animal had dragged quite a sackful of leaves into the burrow. It was, indeed, full of leaves, and the burrow mouth was entirely buried under the leaves which had drifted over it, so that not only was the little stronghold entirely hidden from view, but the sleeper within was certainly secure from rain and frost.

On another occasion I found a great bundle of hay in the corner of a ruined building, and investigation showed it to contain a hibernating hedgehog. Yet another of these beasts decided to hibernate among some sacks in a corner of my motor house, but had to be ejected on account of its primitive sanitary arrangements. In my boyhood one of them several times did his best to settle for the winter under a gardener's coat, which the man was in the habit of throwing down in a corner of the potting shed.

Providing the animal dens up in good health and his den is weather-proof, he will sleep without rousing from early November till the month of March.

**Breeding Habits.**—As is the case with the badger, mating begins immediately succeeding hibernation. According to such evidence as at present exists on the subject, the period of gestation occupies seven weeks, and since the first young are born in March—that is in the south of England—the first hedgehogs must be astir early in February. So far as I know, the sexes never den up together, and I personally have never seen hedgehogs astir before March. In Scotland the young very seldom appear earlier than mid-April. Generally there are two litters during the season—the second arriving as late as August. The latest nest I ever heard of contained newly born young in the middle of September, but this was in Highland country.

The young are born blind, and the quills are present at birth, but they are flexible and white. They first leave the nest with their mother at the age of about eight days, but generally keep to the densest thickets, so that they are very seldom found at

this early age. They remain with their mother until full grown, which accounts for the frequent discovery of a number of hedgehogs together at night-time during the summer months.

Though normally silent animals, hedgehogs possess considerable vocal powers. When trapped they utter a squalling scream which can best be described as midway between the squealing of a rabbit and the sounds of a cat-fight. The young utter various bird-like notes to attract their parents, among these notes being a distinct whistle not unlike that of the blackbird.

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## DATES OF BLOSSOMING OF PLUMS.

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CULTIVATORS of plums from early days appear to have had varied experiences in obtaining satisfactory crops with all kinds of plums; and some varieties were soon termed "bad croppers." Whilst in most cases plums of the gage type, such as Coe's Golden Drop and Late Orleans, appeared in this category, there were other varieties which cropped well in some orchards but proved failures in others, just as Rivers' Early is doing at the present time. The reasons for these varying crops have never been completely understood, but step by step scientific workers are throwing light on these obscure problems.

Assuming that the soil and the tree growth are satisfactory for crop production, it is, in the main, still necessary for the female portion of the blossom (the stigma) to receive the pollen from the male portion before fertilisation can proceed, and the production of a real fruit can commence. Now the blossom of the plum contains both the stigma and the anthers carrying the pollen grains, but for some reason, still obscure, it is the exception rather than the rule for the pollen grains to be active on the stigma of the same variety. In other words, many varieties of plums are self-sterile, and the stigma of one variety needs to be supplied with pollen from another. Pershore Yellow and Purple egg plums, Monarch, Victoria, and Czar, are exceptions, for they possess considerable powers of self-fertility and are able to produce satisfactory crops without the aid of other kinds.

Whilst this has been suspected for many years, its truth has only been confirmed by the work of recent research workers, and it emphasises the need for full details regarding the



behaviour of the blossoms of the varieties usually planted in commercial orchards. Even this would scarcely suffice because a variety of plum remains in blossom, and especially full blossom, for but a few days; nor do all kinds commence to flower at the same time. Mr. Udale, from 21 years' recording work at the Worcestershire County Council Garden at Droitwich with 36 varieties of plum, found the average difference in the time of blossoming of plums, between the earliest varieties to flower and the latest, to be about 18 days. The intervals naturally vary with the prevailing weather, and were as short as 8 days in 1917, and as long as 39 days in 1913. Mr. Cecil Hooper, of Wye College, and others have made observations with similar results.

It is evident that much can be done towards ensuring better crops of fruit by arranging trees of these stone fruits in the orchard in such a way that with the self-sterile varieties there are interplanted some varieties to facilitate pollination. The important point seems to be that the two varieties must have flowering periods which are similar or which overlap to some extent. Thus, Belle de Louvain would appear to be a suitable pollenizer for Pond's Seedling and *vice versa*, but in normal years neither might be of use for, say, Rivers' Early Prolific, for which Pershore Yellow Egg, Czar, or Prince of Wales would be preferred. More records and research are needed before advice in all cases as to the best pollenizers can be given, but fruit growers are indebted to Mr. Udale, Mr. Hooper, and Mr. Crane of John Innes Institute, Merton, and others, for the investigations which they have made into the sterility and fertility of varieties and their order of flowering.

From their records it would appear that plums should be grouped as follows, for flowering and fertility\* :—

*Early Flowering Varieties.*

Black Diamond (S), Prince of Wales (F<sub>1</sub>), Curlew (S), Monarch (F<sub>1</sub>), Jefferson's Gage (S), Coe's Golden Drop (S), Denniston's Superb (F), President (F<sub>2</sub>), Old Greengage (S).

*Mid-season Flowering.*

Rivers' Early Prolific (F<sub>2</sub>), Bryanstone Gage (S), Wyedale (S), Victoria (F), Early Orleans (F<sub>2</sub>), Farleigh Damson (F<sub>2</sub>), Pershore Yellow Egg (F), Pershore Purple (F), Kirker Blues (S), Magnum Bonum (F).

*Late Flowering.*

Czar (F), Washington Gage (S).

*Latest.*

Pond's Seedling (S), Gisborne's Early (F), Kentish Bush (F<sub>2</sub>), Belle de Louvain (F<sub>2</sub>).

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\* (S) means self-sterile.

(F) signifies that the variety is strongly self-fertile.

(F<sub>1</sub>) occasionally self-fertile, and (F<sub>2</sub>) rarely self-fertile.

The result of the cropping of 38 varieties of plums during 21 years at the Droitwich Gardens, recorded by Mr. Udale, gave the following average crop per tree:—Persnore Yellow Egg (70 lb.), Smith's Purple Prolific (55 lb.), Victoria (54½ lb.), Rivers' Early Prolific (44 lb.), Prince of Wales (34 lb.), Monarch (34 lb.), Czar (32 lb.), Jefferson (29 lb.), Belle de Louvain (28 lb.), Pond's Seedling (14 lb.), Czar (11 lb.), and Coe's Golden Drop (7 lb.). The average yield during 21 years of 54 trees of 37 different varieties was 40½ lb. per tree per year.

The trees on which the records were made were planted in 1896, and in the following table there is set out the behaviour as regards blossoming and cropping during the periods of time each of seven years duration.

Whilst there is no definite correlation between the yield and the period of flowering, it does seem to be the case that early blossoming in March is not conducive to high yield, probably because of frost risk.

<i>Year.</i>	<i>Earliest and latest to blossom of 38 varieties of plum.</i>	<i>No. of days difference.</i>	<i>Yield per annum of 54 trees.</i>	
1900 ...	April 19—April 28	9	228¾	<i>First 7 years:</i> Total yield 7,020¼ lb. Average yield per tree per annum— 18½ lb.
1901 ...	April 16—April 27	11	2,110½	
1902 ...	April 5—April 24	19	557	
1903 ..	March 4—April 7	34	93	
1904 ...	April 11—April 24	13	1,303	
1905 ...	March 29—April 18	20	2,713½	
1906 ...	March 28—April 15	18	14½	
1907 ...	April 1—April 21	20	4,359½	<i>Second 7 years:</i> Total yield 19,875 lb. Average yield per tree per annum— 53 lb.
1908 ...	April 13—May 2	19	4,550	
1909 ...	April 12—April 27	15	2,966½	
1910 ...	April 5—April 22	17	2,736½	
1911 ...	April 5—April 22	17	1,603½	
1912 ...	March 17—April 6	20	2,076	
1913 ...	March 9—April 17	39	1,583	
1914 ...	March 29—April 15	17	3,600	<i>Third 7 years:</i> Total yield 18,203½ lb. Average yield per tree per annum— 48 lb.
1915 ...	April 7—April 26	17	1,154¾	
1916 ...	March 29—April 22	24	2,081¾	
1917 ...	April 30—May 8	8	7,332	
1918 ...	March 20—April 4	15	303	
1919 ...	April 18—May 4	16	2,048	
1920 ...	March 4—March 28	24	1,684	
Total yield in 21 years ...			45,098¾ lb.	

Average difference between first and last  
varieties to commence to flower 18½ days.

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## PEPPERMINT: ITS CULTIVATION AND DISTILLATION.

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*Ministry of Agriculture and Fisheries.*

THE Oil of Peppermint of commerce is an extremely pungent volatile oil obtained by distillation of the stems and leaves of species of *Mentha*, a genus of the family *Labiatae*. This oil is the source of the well-known peppermint flavour and aroma, possesses marked medicinal properties, and finds a ready market amongst the confectionery, pharmaceutical and perfumery trades. The oil is also used in the production of creme-de-menthe and other liqueurs.

Peppermint has been cultivated for centuries in the Mitcham district of Surrey, where the acreage once totalled 300 acres, but at the present time is probably not more than 150 acres. Market Deeping in Lincolnshire and Hitchin in Hertfordshire have also been large centres for this industry.

The species grown is *Mentha piperita*, and two varieties are recognised by growers, one being known as black mint (*Mentha piperita nigra*) and the other as white mint (*Mentha piperita alba*). The former is recognised by its purplish stems and dark olive green foliage, while the latter has green stems and lighter foliage, and is generally of less vigorous growth. Also, the leaves of the black mint are much more finely serrated. Although the oil derived from white mint is of a finer quality and commands a higher price than that from black mint, the latter yields more, and is the variety generally grown in this country.

**Cultivation: Suitable Soils and Situations.**—Although an indigenous plant, and therefore more at home in this country than lavender, peppermint has been found to succeed commercially under somewhat similar conditions to those required by that crop, and is therefore generally grown in association with it. It does well in light calcareous soils and is therefore a very suitable crop for the chalk lands, providing, of course, there is a sufficient depth of soil above the chalk. Friable sandy loams or gravels will grow the crop also, in fact any soil is suitable when well drained, except heavy clay.

It has been found, however, that both the quantity and the quality of the oil is influenced by soil and situation. The crop pays best in open sunny situations where the rainfall is not normally excessive during the growing months—April to August

—moist heavy weather affecting the oil production considerably. Being herbaceous it is unaffected by winter conditions, and may therefore be grown where lavender would be killed by the frost.

**Preparation and Planting.**—Having selected the site, care must be taken to ensure its thorough cultivation, bearing in mind that the crop can profitably occupy the land for four or five years if well prepared beforehand.

Unless the land has previously carried a crop which demanded good cultivation, such as potatoes, it should be ploughed and cross ploughed, and if a hard pan is present that must be broken with a sub-soiler.

A good dressing of farmyard manure—from 15 to 20 tons per acre—should be ploughed in, and it will pay to see that the land is thoroughly cleaned and brought into a good state of fertility. The preparation of the land will be done during the autumn and winter, and at the final ploughing it should be laid up in lands about 5 ft. or 6 ft. wide, with furrows about 18 inches wide between. The usual practice is to have the beds about the width of the cart wheels so that the latter run in the furrows, with the least damage to the mint. This bed system of cultivation is the best, as it must be remembered that weeding and harvesting is all done by hand, and pathways at suitable distances apart greatly facilitate operations. Land so prepared will have a good tilth by the spring, when the beds are levelled down with hand rakes and are ready for planting.

In commencing the cultivation of this crop for the first time it will of course be necessary to buy in a stock of mint. Every care must be taken to ensure that the true plant is obtained. It should be purchased if possible from an actual grower, in a recognised peppermint district, otherwise it is a risky matter. This question of stock is a very important one.

Peppermint is propagated by means of young plants which arise in spring from the “runners” or creeping root stocks which are produced in quantity on established beds. A freer production of young plants is often induced by covering the beds with friable soil from the furrows. Planting is done as early as plants become available, usually during March and April. The plants are dibbled in about 12 in. apart to ensure an even spread. It is estimated that about 42,000 plants are required to plant an acre.

In newly planted ground peppermint requires a good deal of hand weeding in order to keep the land free from weeds until the mint is established. A hoe cannot be used without injury





FIG. 1.—Harvesting Peppermint.



FIG. 2.—Peppermint Field at maturity. A Distillery in the background.





to the growing plants. The furrows between the beds must also be kept free from mint, so as to keep a free passage.

After the beds are cleared in the autumn they should receive a dressing of dung, and the beds are ploughed over to divide the runners and cover them with soil. Fish guano and Peruvian guano applied in the spring have been found to give good all-round results in the past, but many growers now apply a dressing made up of sulphate of ammonia, superphosphate and sulphate of potash according to the nature of the land. It certainly pays to apply this annual dressing after the first year and while the crop occupies the land. The potash is especially valuable as it has been found to help the plants resist the rust disease referred to below. A useful dressing would be 1 cwt. of sulphate of ammonia, 2 cwt. of superphosphate, and  $1\frac{1}{2}$  cwt. of sulphate of potash to the acre.

**Harvesting the Crop.**—The crop is ready for harvesting about the second week in August, just before the flowers begin to open. The stills are then got to work and distilling goes on night and day without a break until the crop is finished. Crop time may last 3 or 4 weeks according to the area under cultivation and the rate at which the distilling can be undertaken. As mentioned above, the whole of the plant above ground contains oil and is harvested.

Cutting is done with small sickles known as mint hooks, and should only proceed in fine weather. As the mint is cut it is laid on the beds in long even rows to dry. After lying for a day or two in fair weather it is gathered in small heaps and left again for two days, being turned once in the meantime. Given good weather, the mint should then be in a fair condition for "still-ing," and is then made up into large bundles of about 1 cwt., enveloped in mats, and is carted away to the distillery. In this condition the mint will keep indefinitely, and harvesting is then independent of the capacity of the still to deal with it.

In cutting the mint it is important to see that no noxious weeds are reaped with it and conveyed to the still. Such weeds as ground ivy (*Nepeta Glechoma*), cat mint (*Nepeta cataria*), and goose foot (*Chenopodium* spp.), are particularly troublesome, and must be guarded against, otherwise the flavour and colour of the oil may be injured.

**Distilling.**—The cost of putting down a distilling plant is a considerable item. For this reason, in a peppermint-growing district, the smaller growers generally take their crop to the distillery of larger growers, where it is distilled for an agreed

sum. This is a convenient arrangement and accessibility to a local still is one of the main considerations when commencing to grow this crop on a small scale. On the other hand there are several manufacturing firms who are now making small efficient stills suitable for small growers, and whose advice should be sought.

On account of the bulky nature of the crop the stills must necessarily be of large dimensions. They are best constructed of copper throughout, and are generally built to take charges of from 15 cwt. to 1 ton at a time.

The capacity of the copper depends largely on the state of the crop when it is brought to the still.

A type of still in use amongst several growers is illustrated in the accompanying photograph. The stills are constructed with a false perforated bottom. Water is poured into the empty still until it rises about 2 ft. into the charge chamber. The mint is then packed in and firmly trodden down until the load is level with the top of the still. The still head is then let down by pulleys and clamped down into a waterseal joint.

The distillation is conducted by boiling the water beneath the charge chamber by means of steam conveyed from a boiler at pressure to a coil, the top of which should be well beneath the false bottom. The application of direct heat to the stills is now obsolete on account of the risk of burning, etc.

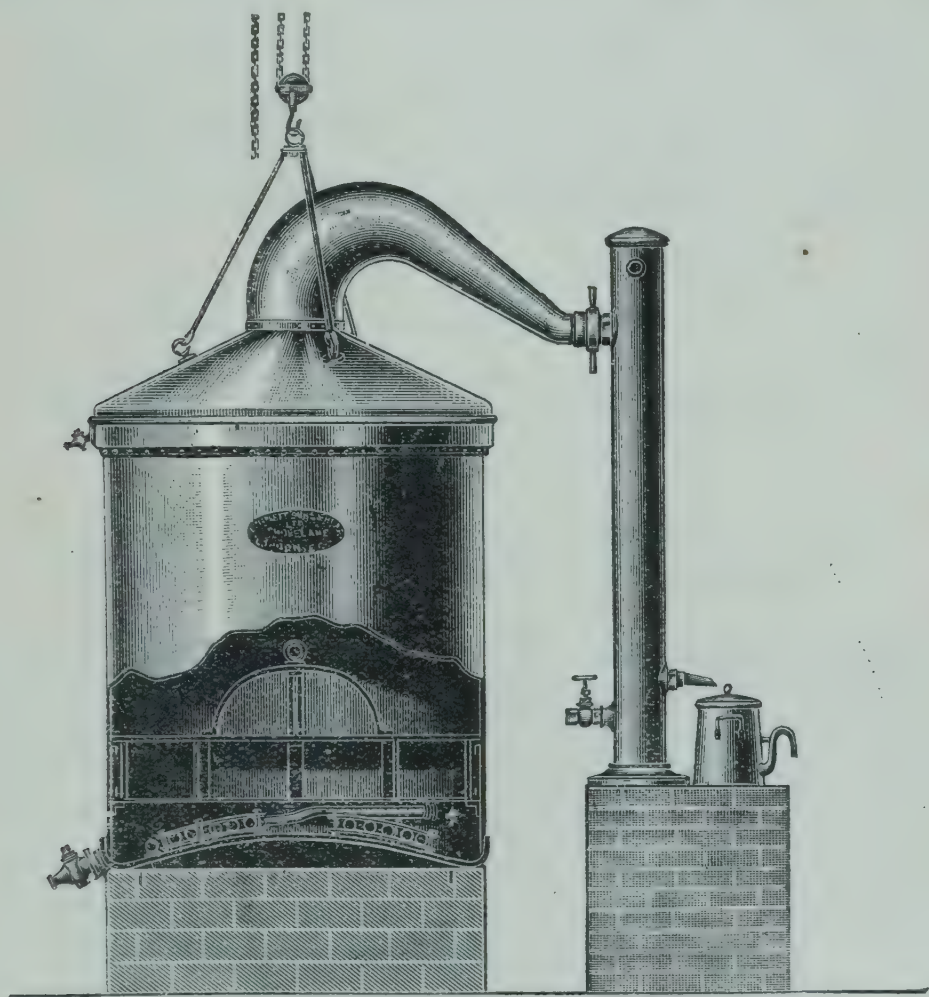
The distillate will commence to pass over in about half an hour, and complete distillation of the charge usually takes about six hours, by which time all the oil will have passed over. The oil is completely insoluble in water, and readily separates out in the separator as it comes from the condenser. After each charge the oil is "taken off" by first pouring off the "mother liquor," which is saved and put back into the next charge along with the overflow in the tanks, the oil being then poured into Winchesters and weighed, so that a check can be kept upon the yields.

After each distillation the charges are drawn by special gear, the spent mint being carted back to the fields by the returning carts, and rotted down for manure. This spent mint forms good organic manure, and should be mixed with the farmyard dung which is applied to the land in the autumn as above stated.

**Yield.**—It is difficult to give any definite figures as to yield. As stated above the oil production is extremely variable, being influenced considerably by the season, soil, and situation, as also is its quality in respect of flavour and odour. When grown



under conditions which tend to assist oil production, and given a fair season which has been warm and dry, a yield of oil at the rate of from 10-12 lb. to the ton of partly dried mint would be a good return. An average crop of green mint grown under favourable conditions on established beds would be between 3 and 4 tons per acre. A good average yield for well-cultivated commercial crops would therefore lie between 30 and 40 lb. of oil to the acre. Under adverse conditions only half these figures might apply, whereas record yields have been obtained under extremely favourable conditions as high as 100 lb. to the acre.



A modern Peppermint Still, showing new pattern Condenser.

The oil is usually disposed of straight away to the merchants, by whom it is mellowed in storage before being sold to the consumer. The product is extremely sensitive to light and temperature, and must be stored in complete darkness, preferably below ground in concrete chambers.

**Diseases.**—Peppermint is often badly attacked by Mint Rust, sometimes referred to as “Snuff disease” by growers,

caused by *Puccinia menthæ*. This disease has been known to destroy whole beds of mint, and must be constantly watched for, and precautions taken against its spread should it appear. It is easily distinguishable, as all stages appear on the one host, the bright orange cluster cup phase of the fungus, which appears in the early summer on the stem, being especially noticeable. This disease is most troublesome during wet seasons, and it should be borne in mind that all species of wild mints are often badly attacked, and may provide a source of infection if left undestroyed.

The only remedy, once the disease has appeared, is to remove the affected plants entirely and burn them. Affected plants can be distinguished very early in the season, before spores are produced, by their pale leaves and distorted, stunted stems. The mycelium of the fungus winters over in the underground portion of the plant, therefore plants once attacked are likely to remain attacked unless destroyed.

\* \* \* \* \*

## NOTES ON MANURES FOR NOVEMBER.

SIR JOHN RUSSELL, D.Sc., F.R.S.,  
*Rothamsted Experimental Station, Harpenden.*

**The Cropping Policy.**—One of the most serious questions now engaging the farmer's attention is the cropping policy that should be followed on the farm. It is an extraordinarily difficult question, and one that in the end each man must decide for himself after full consideration of all the circumstances of his own case. The fundamental idea underlying these notes, and indeed all of the writer's work, is that whether a man lays down more grass or whether he keeps up his arable area, he must produce good crops or he cannot meet his standing charges. Unmanured arable crops give less profitable returns in good times, and in bad times they involve a greater loss of money, than crops which are properly manured. Much of the grass land of the country, both hay and grazing, can be considerably improved and made more profitable by suitable manuring. There is, of course, such a thing as over manuring, but in ordinary farm practice this is very rare; it is much more common to see unsuitable and therefore wasteful manuring. In the writer's experience, however, a crop which is unprofitable when properly manured, does not become profitable



by giving less manure. In his view the proper way to meet low prices is to go carefully over every item of expenditure and every process in the production of the crop to discover whether it is possible to bring down the cost of production per ton or per bushel of produce; to see also if it is possible, by using improved varieties, by better schemes of manuring, or by better soil management to obtain larger yields at the same or only slightly greater expenditure of money. If when all this is done, it still appears that the farmer's best efforts will involve him in a loss, then let him put his land into some other crop.

**Can Kainit be applied late to Wheat?**—On chalk soils kainit is well known to have a beneficial effect on wheat, and a correspondent asks whether it is safe to apply this substance after the wheat is up. There is probably little risk of injury in the autumn or early winter, but it is unwise to use kainit in this way on arable crops; its proper use is to go in with the seed or earlier.

Kainit, as is well known, is the least concentrated of the potassic fertilisers; it contains salt, and in the case of German kainit, a magnesium compound as well. The salt and probably the magnesia have value on light soils and on mangolds, though they are not as useful as potash itself. The so-called "extra kainit" and the potash manure salts are both more concentrated, supplying a larger amount of potash per ton; they may prove more economical where cartage or freight charges are heavy.

**Manuring of Leys: Use of Longer Leys.**—Special attention should be given to the leys, as where a mixture has been sown in place of pure clover it may be found desirable to keep the ley down for another year. A dressing of basic slag or finely-ground mineral phosphate (120-mesh sieve) is useful in early winter if the clovers are well established, but where the clover has failed in many places it is probably better to wait till spring and then apply a nitrogenous manure to bring on the grasses. The best time for manuring of leys, however, is when the nurse crop is being sown; the slag or mineral phosphate put on then helps the young clovers considerably. It may happen, however, as at Rothamsted this year, that potassic fertiliser is also necessary. Clovers sown in a nurse crop of barley which had received potash as well as phosphates made much better growth and gave a heavier yield than when the barley had received phosphates only. It is only when the manuring of the nurse crop has been omitted that it becomes necessary to put manure on to the stubbles of the nurse crop.

**A London Ash-pit Refuse.**—The Council of one of the large London boroughs has been pulverising refuse after the removal of rags and bones and has obtained a product in a fairly fine state of division :—

Moisture	...	...	...	...	...	18·20
* Organic Matter	...	...	...	...	...	20·08
Oxide of Iron and Alumina	...	...	...	...	...	8·68
† Phosphoric Acid	...	...	...	...	...	0·37
Lime	...	...	...	...	...	3·40
Potash	...	...	...	...	...	0·32
Magnesia, Alkalies, etc.	...	...	...	...	...	6·34
Insoluble Siliceous matter	...	...	...	...	...	42·61
						<hr/> 100 00 <hr/>

* Containing Nitrogen	...	...	...	0·36
Equal to Ammonia	...	...	...	0·44
† Equal to Tribasic Phosphate of Lime				0·81

This material is poor in organic matter, the chief fertilising constituent of town refuse, though it would have a good effect in lightening heavy soils. It would probably be useful to heavy land farmers if it could be obtained on the field at 3s. to 4s. per ton, though it would hardly be worth more.

If the rags and bones were left in a richer material would be obtained, but probably it is more economical to separate these substances and sell them separately.

**Some Cheap Lime.**—One of the large chemical manufacturers of the north is putting on the market a waste lime which has been dried and pulverised, containing about 80 per cent. carbonate of lime, or 44·8 per cent. of calcium oxide, the remainder being water, at a price of 5s. per ton. This is very cheap and should allow of the application of lime to soils badly needing it but in regard to which the cost of the dressing has hitherto been prohibitive.

\* \* \* \* \*



## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending October 10th.				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ... ..	13.12	13.15	13.10	13. 2	16.11
" " Lime (N. 13 per cent.) ... ..	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 9*	13. 9*	13. 9*	13. 9*	(N)13. 0
" " " neutral (A. 25¾ per cent.)	14.12*	14.12*	14.12*	14.12*	(N)13.10
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	1.17	3. 0
" (Pot. 14 per cent.) ... ..	2. 2	...	2.10	2. 5	3. 3
Sylvinit (Pot. 20 per cent.) ... ..	...	...	...	2.10	2. 6
Potash Salts (Pot. 30 per cent.) ... ..	...	...	...	3.10	2. 4
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 0	8. 0	7. 0	2.10
Sulphate of Potash (Pot. 48 per cent.) ...	...	...	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.) ... ..	...	...	...	3.10§	2. 0
" (T.P. 30 per cent.) ... ..	...	...	...	2.17§	1.11
" (T.P. 26 per cent.) ... ..	2.13§	2. 8§	...	...	...
" (T.P. 24 per cent.) ... ..	2. 9§	2. 4§	2. 2§	...	...
" (T.P. 20-22 per cent.) ... ..	...	2. 1§	...	2. 5§	2. 3
" (T.P. 18 per cent.) ... ..	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.17	...	3. 7§	3. 7	1.11
" (S.P. 30 per cent.) ... ..	3.10	...	3. 0§	3. 0	2. 0
Bone Meal (T.P. 45 per cent.) ... ..	9.10	...	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ...	...	6.10†	6.15	6. 2	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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## MONTHLY NOTES ON FEEDING STUFFS.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),  
Animal Nutrition Institute, Cambridge University.

**The Use of Home-Grown Foods for Stock.**—Notes have appeared in this column and elsewhere from time to time on the value and use of home-grown feeding stuffs. From the opinions that the writer has obtained from practical farmers it seems clear that there is no agreement among them on the value and use of home-grown cereals. Barley may be taken as a case in point. In the Eastern Counties generally barley is looked upon with disfavour for use with any stock other than fattening pigs. If used to any extent with breeding sows or with dairy cows it is said to dry up the milk.

On the other hand, it is a common practice in the North of England to feed barley to milch cows in conjunction with other foods. A farmer recently informed the writer that he placed great reliance on soaked barley as a milk producer, used in suitable conjunction with other foods.

In view of this lack of agreement, any positive evidence on the practical side of the value of suitable mixtures of home-grown feeding stuffs for stock is worth recording, and the writer, through the kindness of a correspondent, is enabled to record one experience on the value of home-grown foods. This correspondent has been accustomed for some time past to feed his own corn to stock with favourable results. Last year he ground up over 2,000 bushels of wheat, barley, oats and beans. The following are the mixtures he likes best for the different classes of stock:—For pigs, a mixture of 1 cwt. of wheat, 1 cwt. of beans and 3 cwt. of barley. For dairy cows and fattening cattle or young calves over two months, 1 cwt. of beans, 2 cwt. oats, 1 cwt. wheat, and 2 cwt. of pure linseed cake. The first ration has a nutritive value of approximately 1:6, the second approximately 1:4. This second ration, except possibly for the young calves, is rather narrow and it should be possible to reduce the amount of linseed cake without interfering materially with the dietetic value of the mixture.

**Use of Home-Grown Linseed for Stock.**—The cultivation of a breadth of linseed for stock feeding is an increasing practice. Linseed is a valuable feeding stuff for all classes of stock. It is, however, inadvisable to use it for pigs intended for bacon. Linseed as grown contains 36 per cent. of oil, and if used to any extent for pigs intended for bacon an unsuitable oily carcass will be produced. Farmers, therefore, should not use linseed in any mixtures given to pigs intended for bacon, but should confine its use to breeding stock, milch cattle and working horses.

#### FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.E. d.
	£ s.	£ s.	£ s.			
Wheat - - - - -	7 18	0 15	7 3	71·6	2 0	1·07
Oats - - - - -	6 12	0 13	5 19	59·5	2 0	1·07
Barley - - - - -	7 14	0 12	7 2	71·0	2 0	1·07
Potatoes - - - - -	1 19	0 3	1 16	18·0	2 0	1·07
Swedes - - - - -	0 16	0 2	0 14	7·0	2 0	1·07
Mangolds - - - - -	0 15	0 3	0 12	6·0	2 0	1·07
Good Meadow Hay - -	4 5	0 13	3 12	31·0	2 4	1·25
Good Oat Straw - - -	2 7	0 7	2 0	17·0	2 4	1·25
Good Clover Hay - - -	4 15	1 0	3 15	32·0	2 4	1·25
Vetch and Oat Silage -	1 17	0 7	1 10	14·0	2 2	1·16



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.					
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British - - -	—	—	9/3	9 5	0 15	8 10	71·6	2/4	1·25
Barley, British Feeding - -	—	—	8/10	8 17	0 12	8 5	71	2/4	1·25
" Canadian No. 4 - - -	30/3	400	8/6	8 10	0 12	7 18	71	2/3	1·20
Western - - -	31/-	400	8/8	8 13	0 12	8 1	71	2/3	1·20
" Danubian - - -	—	—	10/6	10 10	0 13	9 17	59·5	3/4	1·78
Oats, English, White - - -	—	—	—	—	—	—	—	—	—
" " Black and - - -	—	—	—	—	—	—	—	—	—
Grey - - -	—	—	8/10	8 17	0 13	8 4	59·5	2/9	1·47
" Canadian No. 2 - - -	—	—	—	—	—	—	—	—	—
Western - - -	29/3	320	10/3	10 5	0 13	9 12	59·5	3/3	1·74
" " No. 3 " - - -	28/6	"	10/-	10 0	0 13	9 7	59·5	3/2	1·70
" " Feed - - -	28/-	"	9/10	9 17	0 13	9 4	59·5	3/1	1·65
" American - - -	24/9	"	8/8	8 13†	0 13	8 0	59·5	2/8	1·43
" Argentine - - -	24/9	"	8/8	8 13	0 13	8 0	59·5	2/8	1·43
Maize, American - - -	43/9	480	10/3	10 5†	0 13	9 12	81	2/4	1·25
" Argentine - - -	37/-	"	8/8	8 13	0 13	8 0	81	2/-	1·07
" South African - - -	38/6	"	9/-	9 0	0 13	8 7	81	2/1	1·12
Beans, English, Winter - -	—	—	9/6	9 10	1 12	7 18	67	2/4	1·25
" Rangoon - - -	—	—	7/9	7 15†	1 12	6 3	67	1/10	0·98
Peas, English, Dun - - -	—	—	10/-	10 0	1 8	8 12	69	2/3	1·34
" Japanese - - -	—	—	28/-	28 0†	1 8	26 12	69	7/8	4·10
Millers' offals:—									
Bran, British - - -	—	—	—	6 5	1 6	4 19	45	2/2	1·16
" Broad - - -	—	—	—	7 5	1 6	5 19	45	2/8	1·43
Middlings, Coarse, - - -	—	—	—	—	—	—	—	—	—
British - - -	—	—	—	8 2	1 2	7 0	64	2/2	1·16
Pollards, Imported - - -	—	—	—	6 2	1 7	4 15	60	1/7	0·85
Meal, Barley - - -	—	—	—	10 2	0 12	9 10	71	2/8	1·43
" Maize - - -	—	—	—	10 15	0 13	10 2	81	2/6	1·34
" " Germ - - -	—	—	—	9 10	0 19	8 11	85·3	2/-	1·07
" Gluten-feed - - -	—	—	—	8 10	1 7	7 3	75·6	1/11	1·03
" Locust Bean - - -	—	—	—	8 0	0 9	7 11	71·4	2/1	1·12
" Bean - - -	—	—	—	12 2	1 12	10 10	67	3/2	1·70
" Fish - - -	—	—	—	17 5	4 6	12 19	53	4/11	2·63
Linseed - - -	—	—	—	21 17	1 11	20 6	119	3/5	1·83
" Cake, English - - -	—	—	—	11 12	1 18	9 14	74	2/7	1·38
Cottonseed Cake, English - -	—	—	—	7 12	1 14	5 18	42	2/10	1·52
" " Egyptian - - -	—	—	—	7 7	1 14	5 13	42	2/8	1·43
Decorticated Cotton - - -	—	—	—	—	—	—	—	—	—
Cake, 8% - - -	—	—	—	11 17	2 14	9 3	71	2/7	1·38
Decorticated Cotton - - -	—	—	—	—	—	—	—	—	—
Meal 7% - - -	—	—	—	12 10†	2 14	9 16	71	2/9	1·47
Coconut Cake 6% - - -	—	—	—	8 12	1 10	7 2	73	1/11	1·03
Palm Kernel Cake 6% - - -	—	—	—	5 15†	1 3	4 12	75	1/3	0·67
" " Meal 2% - - -	—	—	—	5 2	1 4	3 18	71·3	1/1	0·58
Brewers' Grains:—									
Dried Ale - - -	—	—	—	6 17	1 4	5 13	49	2/4	1·25
" Porter - - -	—	—	—	6 5	1 4	5 1	49	2/1	1·12
Wet Ale - - -	—	—	—	1 1	0 9	0 12	15	0/10	0·45
" Porter - - -	—	—	—	0 18	0 9	0 9	15	0/7	0·31
Malt Culms - - -	—	—	—	7 10†	1 14	5 16	43	2/8	1·43

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of September and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s. per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 12s. 7d.; P<sub>2</sub>O<sub>5</sub>, 4s. 4d.; K<sub>2</sub>O, 2s. 4d.

**The Ostend Style.**—During the season, viz., from about the middle of September to the end of March, there is always a demand in the London Markets for home-produced rabbit carcasses dressed in the “Ostend” style. It needs only a little extra care and attention to method on the part of the home producer to secure for himself a preferential position in these markets, as dealers are almost invariably inclined to favour the British produce in preference to the imported, provided it is marketed in proper condition. “Ostend” rabbits are a far more saleable commodity than a rabbit which is sold in its skin, or than the wild rabbit dressed in the markets. Indeed, dealers at times have found it profitable to skin and dress in the “Ostend” style tame rabbits coming into the market for sale in their skins. The “Ostend” method requires that the carcass should be skinned with the exception of the hind feet; the fore feet should be tucked into the ribs and the carcasses paunched in such a manner that the belly is cut open from the top ribs halfway down only, so that the liver is covered and not likely to become detached. It should be remembered, however, that in killing rabbits which are to be dressed in this style, the jugular vein should be severed and the animal bled, as the whiteness of the flesh is thereby preserved.

The Ministry understands that certain dealers\* in London are prepared to take British tame rabbits in the “Ostend” style, described above, in any number from one upwards, provided (a) That they are cleanly paunched; (b) That they have been allowed to cool before being packed; (c) That they are properly packed; (d) That they are despatched so as to arrive in the market by 6 a.m.; and (e) That they are sent only in the season, i.e., during the cold weather from mid-September to the end of March. It is found that there is a prejudice against rabbits at other seasons of the year. It is alleged that producers are often so careless in preparing them for the market and in their methods of packing, that late consignments during the warm weather are as often as not unfit for human consumption when they reach the market.

Before consigning rabbits for the first time to any of the dealers, rabbit keepers should communicate with the firm direct, mentioning the fact that the dealer's name has been obtained from the Ministry.

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\* A list of these dealers can be obtained on application to the Ministry.



**Alternative Style of Dressing.**—It may be of interest to include here a description of the method of marketing followed at the Ministry's Farm Settlement, Patrington, Hull, which has proved remunerative and has given satisfaction to all concerned.

After killing, the rabbits are skinned and paunched; then hung up exactly in the same way as a sheep with a stick round the back to hold the carcass open and to display the kidneys and fat. When cold and "set" each rabbit is wrapped in butter paper and a second wrapping of newspaper. The rabbits are then packed in grass mats, the largest of which are capable of holding five to six couples, weighing about 50 lb. Smaller consignments are sent in smaller mats. This method of despatch represents a great saving as against that of packing in crates or hampers. A London firm takes all the rabbits produced at the Patrington Farm Settlement, and have expressed their willingness to accept suitable lots from other senders.

The object of these notes is to show that a little extra care and trouble in marketing rabbits have their reward in the enhanced prices realised by a finished product. A detailed description of the various steps in the preparation of rabbits for the table and markets is given in the Ministry's Leaflet No. 265.

\* \* \* \* \*

THE August number of the "International Labour Review" contains an interesting article by Mr. H. M. Conacher of the Board of Agriculture for Scotland on the regulation of agricultural labour conditions in Continental Europe.

**Agricultural  
Labour Conditions  
Abroad.**

"The problem," says Mr. Conacher, "depends in some part on factors of climate, land tenure and the consumption demand of the populations." For the purposes of comparison the article divides Europe into three zones—Northern, Southern and Eastern, and Mid-Europe.

In the Northern Zone the carrying-on of agricultural operations is based on the work of the whole-time labourer. Large holdings are fairly common, and the keeping of stock is closely allied with arable farming. Great Britain and Northern Germany are the most populous countries where this industrial farming exists, and the amount of labour engaged in each country is considerable.

In the South of Europe (Spain, South Italy and Sicily) the system is one of capitalist farming based on large-scale holdings. The keeping of stock is divorced from arable farming, which

tends to be exclusively a matter of grain-growing, and there is also the distinctive cultivation of the vine, olive and sugar cane. Few permanent workers are employed on such plantation systems, and the labouring classes live in large villages and seek work at the different seasons over a wide area. Hungary and Rumania are in a similar position; large estates are common, the landowner wants all his labour at certain important seasons, and little work is available in the intervals.

The Mid-European Zone is described as an area in which peasant landholders and peasant agriculture predominate. The peasant raises stock in the Alps, cultivates the vine in Italy, Spain and Southern France, and cereals in the lowlands, but wherever he is found the labour of himself and his family is the dominant factor.

Mr. Conacher goes on to discuss the conditions of the workers under the different systems, and the practicability of various forms of ameliorative measures such as land settlement and social insurance.

\* \* \* \* \*

At the Annual Fruit Growers' Conference in Wellington, New Zealand, it was decided to seek powers for the Federation

**Standardising  
Fruit in  
New Zealand.**

to take control of standardisation, marking and advertisement, and to make a levy up to a maximum of a penny a case.

Mr. J. A. Campbell, Director of Horticulture, outlined the Department's proposals, which, he said, were intended as the first step towards getting standardised fruit on the market. Compulsory standardisation was not any part of the scheme, at present. What was wanted, he said, was the elimination of the rubbish from the market. The growers' position was absolutely critical, and a continuance of the present state of things must lead to the bankruptcy of many hard-working men. Leaflets were being issued by the Department urging:—1. The adoption of the existing standardised regulations; 2. Packing in accordance with those grades and the use of the proper labels; 3. Salesmen to display standardised fruits separate from unstandardised; and 4. Not to offer standardised fruit for sale until it had been inspected by the Fruit Inspector of the Department, who would either pass, regrade or transfer it to unstandardised, so that buyers may be able to rely on the quality of fruit bearing the label of standardisation.

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**List of Potato Varieties.**—A note in this *Journal* for October, 1923, p. 669, announced that the Board of Agriculture for Scotland had prepared a list of all potato varieties. It should, however, have been stated that the price of the list is 2s. 6d., post free, from the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

**Courses at Farm Institutes.**—The statement below shows the courses to be held during the 1923-4 session at Farm Institutes recognized by the Ministry. A note on the purposes of Farm Institute courses appeared in the *Journal* for September, 1923, p. 485.

Name and location of Institute.*	Description of Courses.	Fees. (Board, lodging and tuition unless otherwise stated.)
Cheshire : Cheshire School of Agriculture, Reaseheath, near Nantwich.	(a) Winter Courses, of about 22 weeks' duration, in Agriculture and Horticulture. (b) Short courses in Dairying and Poultry-keeping. (c) Courses, intended for beginners, of practical training in farm or garden work.	Students resident in county, 1 <i>l.</i> per week. Other students, 1 <i>l.</i> , 15s. per week.
Cumberland and Westmorland Farm School, Newton Rigg, near Penrith.	(a) Winter Course (Agriculture) of 20 weeks, October to March, in science and practice of Agriculture with special reference to Dairy-farming and Stock-rearing. (b) Three Summer Courses (Dairying and Poultry-keeping) of from 4 weeks' to 12 weeks' duration, April to September. (c) Special pupils are admitted for practical training in Farm Management.	Westmorland students } 1 <i>l.</i> per week. Cumberland students } Students from other counties 2 <i>l.</i> per week.
Essex : East Anglian Institute of Agriculture, Chelmsford.	(a) Winter School of Agriculture of 20 weeks' duration, October to March. <i>Note.</i> —There is no farm attached to the Institute. All students previous to attending this course must spend at least one year on a farm, taking an active part in all farming operations. (b) Dairy School. Three courses of from 12 weeks' to 16 weeks' duration. N.D.D. 2 years' course (6 terms); also qualifies for diploma of B.D.F.A. (c) School of Horticulture. Course of three terms, viz., Autumn Term, 3 weeks; Spring Term, 4 weeks; Summer Term, 4 weeks. Practical instruction is given at the County Gardens.	(a) Residents in administrative county of Essex and County Borough of Southend, 5 <i>l.</i> for 20 weeks. Students from outside the county, 1 <i>l.</i> per week. (b) Residents in administrative county of Essex and County Borough of Southend, nil. Pupils from outside the county, 15s. per week. (c) Residents in administrative county of Essex, and County Borough of Southend, nil. Students from outside the county 15s. per week.

\* Further particulars may be obtained in each case from the Principal of the Farm Institute.

Name and location of Institute.*	Description of Courses.	Fees. (Board, lodging and tuition unless otherwise stated.)
Hampshire : Sparsholt Farm Institute, near Winchester.	Instruction in Agriculture, Horticulture, Poultry-keeping, Dairy- ing and Bee-keeping. (a) One year's course in above subjects :—Winter Course of 24 weeks, October-March. Summer Course of 15 weeks, April-July. (b) One year's course should be taken in preparation for the B.D.F.A. (Butter and Cheese) certificate examinations. (c) Short courses can be arranged in special subjects.	Students resident in administrative county of Hampshire, 1l. per week. Other students, 1l. 15s. per week.
Hertfordshire : Hertfordshire Agricultural Institute Oaklands, St. Albans.	(a) One year's course in Agriculture, of three terms, commencing respectively October, January, May. (b) Dairying Courses (i.) One year's course, commencing October. (ii.) Summer Course, April to August. (iii.) Short courses in Special Dairy Subjects (Clean Milk Production, Soft Cheese making and Disposal of Surplus Milk). (c) 12 weeks' course in Horticulture extendable to one year. (d) Two one month courses in Agriculture for non-residential students in December and January respectively. (e) 20 weeks' course in Poultry-keeping extendable to one year.	Students resident in county, 1l. 15s. per week. Students from other counties, 2l. 10s. per week. Day students, 10s. per week.
Northamptonshire : Northamptonshire Farm Institute, Moulton, Northampton.	(a) Winter Course of 22 weeks (October to March) in the science underlying the practice of Agriculture. (b) Summer Course, for Women, of 10 weeks (May to July) in Dairy Farming. (c) A limited number of Farm pupils can be taken from April to October for practical training in mixed farming with special reference to Live Stock Husbandry.	Resident pupils :— (1) From Northamptonshire, 23s. per week. (2) From outside the county, 31s. 6d. per week. Non-resident pupils :— (1) From Northamptonshire, 5s. per week. (2) From outside the county, 10s. per week.
Somerset : Cannington Court Farm Institute, Cannington, Bridgwater.	(a) Agriculture and Horticulture, one year's course, three terms each of 12 weeks' duration. (b) Dairying and Poultry-keeping—Full course, 12 weeks; short courses, 4 weeks.	Somerset students, 18l. per term. Other students, 28l. per term. (For short courses, 1l. 15s. and 2l. 10s. per week respectively.)
Staffordshire : Staffordshire Farm Institute, Rodbaston, Penkridge, Stafford.	(a) Winter Course in Agriculture for youths from 16-20 years, 22 weeks (October to March). (b) Summer courses for women in Dairying, Poultry-keeping, Bee-keeping and Horticulture, 11 weeks (April-July).	Fees for Winter Course— Tuition fee, all students, 5l.; maintenance fee, students resident in administrative county of Stafford, 25l.; students from outside the county, 45l.; day students, 7l. 10s.



Name and location of Institute.*	Description of Courses	Fees. (Board, lodging and tuition unless otherwise stated.)
Staffordshire— <i>cont.</i>		Fees for Summer Course —Inclusive fee for students resident in administrative county of Stafford, 12 <i>l.</i> ; students from outside county, 20 <i>l.</i>
Chadacre Agricultural Institute, Hartest, Bury St. Edmunds, Suffolk.†	(a) Course in Agriculture for male students comprising two Winter Sessions of six months (two terms) each. (b) Spring and Summer Courses (nine weeks each) in Dairying, Horticulture, Poultry-keeping and Bee-keeping, for women students.	Male students — FREE tuition, board and residence to selected students. Female students — resident in the county of Suffolk; tuition and residence FREE, board 15 <i>s.</i> per week. Students resident outside the county of Suffolk; board residence and tuition 25 <i>s.</i> per week.
Carnarvonshire : Madryn Castle Farm School, Pwllheli.	(a) Winter Course in Agriculture for men (20 weeks), October to March. (b) Summer Course in Dairying, Poultry-keeping, Bee-keeping and Domestic Science for women (12 weeks), April to July.	(a) Carnarvonshire students, 17 <i>l.</i> 10 <i>s.</i> Other students, 30 <i>l.</i> (b) Carnarvonshire students, 10 <i>l.</i> 10 <i>s.</i> Other students, 18 <i>l.</i> Special Course, 35 <i>s.</i> per week.
Denbighshire : Llysfas Farm Institute, Ruthin.	(a) Autumn Course in Agriculture for men (8 weeks), October to December. (b) Winter Course in Agriculture for men (8 weeks), January to March. (c) Spring Course in Dairying, Horticulture, and Poultry-keeping for women (8 weeks), April to June. (d) Summer Course in Dairying for women (8 weeks), July to August.	Board, lodging, and tuition to residents in the County, 22 <i>s.</i> 6 <i>d.</i> per week. Non-residents, 25 <i>s.</i> per week.
Monmouthshire Agricultural Institution, Usk.	(a) One year's Certificate Course. (b) Two years' Diploma Course. Winter Term of 22 weeks (October to March). Summer Term of 22 weeks (April to September). These courses include all branches of Agriculture. Students may specialise in General Agriculture, Dairying, Poultry-keeping and Commercial Horticulture, the last named subject being a particular feature.	Tuition, board and residence :— 15 <i>l.</i> per session (22 weeks) for Monmouthshire students; 32 <i>l.</i> 10 <i>s.</i> for other students. Tuition only :— 2 <i>l.</i> per session for Monmouthshire students; 5 <i>l.</i> for other students.

† The authority responsible for this Institute is the Trustees of the Earl of Iveagh's Foundation.

The Ministry, with the approval of the Development Commissioners and the Treasury, has awarded the following special research grants for work in connection with agricultural problems during the Academic year October, 1923, to September, 1924. These grants are in addition to the annual grants in aid made to Universities and Research Institutes for the maintenance of agricultural research departments,

<i>Institution.</i>	<i>Investigation.</i>	<i>Amount.</i>
Armstrong College, New-castle	Research in composition of oat straw (6 months) ... ..	£ 120
Cambridge, School of Agriculture	Soil bacteriology ... ..	300
Cambridge, School of Agriculture	Statistical examination of milk records ...	250
Imperial College of Science & Technology	Change of seed in potatoes ... ..	60
Imperial College of Science & Technology	Mosaic disease of hops (6 months) ... ..	170
Waltham Cross Experimental Station	Fertilising effect of carbon dioxide ...	300
Wye, South-Eastern Agricultural College	Turnip and Swede seed beetles ... ..	120
Aberystwyth, University College of Wales	Nutritive value of grasses ... ..	150
Bangor, University College of North Wales	Dry rot of swedes ... ..	165
Bristol University	Striking of cuttings ... ..	50
Edinburgh University Animal Breeding Research Department	Breeding experiments with merino sheep ...	700
Imperial College of Science & Technology	Investigation of flea beetles ... ..	200
Imperial College of Science & Technology	Physiological effects of insecticides ... ..	270
Leeds University	Healing of wounds in woody plants ... ..	20
Leeds University	Breeding experiments on the colour of Wensleydale sheep ... ..	100
Midland Agricultural and Dairy College	Labour force required in production of crops, etc. ... ..	175
Oxford, School of Rural Economy	Nitrogen yield in certain soils... ..	275
Wye, South Eastern Agricultural College	Wild white clover investigation ... ..	300
	Total ... ..	£3,725

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**Lectures on the Rothamsted Experiments.**—The Director of the Rothamsted Experimental Station, Harpenden, announces that during the forthcoming winter it will be possible for Mr. H. V. Garner, the Guide Demonstrator of the Institution, to give a few lectures to Chambers of Agriculture and Horticulture, Farmers' Clubs, Agricultural Societies, etc., on the Rothamsted Experiments in regard to:—(1) Manuring of Root Crops and Potatoes, (2) Manuring of Cereals, (3) Manuring of Grass Land, (4) Manuring of the Rotation. (5) The Management of Farm Yard Manure. (6) Chalking and Liming. (7) The carrying out of Field and Feeding experiments.

Any such association wishing to avail itself of Mr. Garner's services is invited to communicate with the Secretary of the Station, indicating the subject or subjects which would be of most interest to its members, and



convenient dates. No fee will be charged for Mr. Garner's services, but any association engaging him would be expected to defray his travelling expenses and to make such arrangements for the lecture as may be necessary.

**Foot-and-Mouth Disease.**—*Buckinghamshire and Devonshire.*—No outbreak having occurred in either of these counties since 14th and 12th September, respectively, the remaining general restrictions imposed by Orders of the Ministry were withdrawn in the case of Buckinghamshire as from 19th October and in the case of Devonshire as from 16th October.

*Fresh Centres.*—Since the October issue of the *Journal*, fresh centres of foot-and-mouth disease have appeared in the following places:—

- (1) 23rd September, at Whitchurch, Nr. Bristol, Somerset.
- (2) 23rd September, at Grimsby (Lindsey), Lincs.
- (3) 28th September, at Ipstones, Nr. Leek, Staffs.
- (4) 1st October, at Barnoldswick, Yorks (W.R.).
- (5) 1st October, at Adney, Nr. Newport, Salop.
- (6) 1st October, at Cranleigh, Surrey.
- (7) 6th October, at Hatfield Heath, Harlow, Essex.
- (8) 10th October, Nr. Leeds, Yorks (W.R.).
- (9) 12th October, at North Farnborough, Hampshire.
- (10) 12th October, at West Hoathly, East Grinstead, East Sussex.
- (11) 13th October, at Wigan, Lancs.
- (12) 20th October, at Sprowston, near Norwich, Norfolk.
- (13) 25th October, at North Burton, Bridlington, Yorks.

*Origin.*—No definite origin has been discovered for the initial outbreaks in the above-mentioned centres (1) to (7), (9) and (10).

*Yorkshire.*—The outbreaks near Leeds, centre (8), were attributable to the exposure of animals in the incubative stage of the disease at Whitkirk Auction Marts on 1st and 8th October, and in Skipton Market on 24th September. Animals connected with the first Barnoldswick outbreak were exposed at Skipton Market on 24th September, and animals purchased at Skipton Market were taken to the Leeds district, the purchaser subsequently exposing animals from his premises at Whitkirk Auction Marts on the dates mentioned. As distribution from these markets was considerable the Ministry imposed restrictions on movement over practically the whole of the West Riding and some adjoining portions of the East and North Ridings of Yorkshire. Other outbreaks have followed, directly attributable to the same source. It appears from first reports that infection was conveyed to the East Riding from the Leeds district before the Leeds outbreak was reported.

*Lancashire (Wigan).*—When the reported outbreak at Wigan was confirmed on 13th October it appeared from inquiries that certain of the diseased animals had been exposed at Chester Market on 9th or 11th October, and that the animals were possibly in an infective stage when at that market. In these circumstances the Ministry considered it necessary to impose a Prohibition of Movement Order over the whole of the area of distribution from Chester Market, including the remaining portions of Lancashire, Cheshire, Flintshire and Denbighshire not already under foot-and-mouth disease restrictions, and also a small part of Carnarvonshire. From later information it appeared that there might be another channel by which infection was conveyed to the animals brought from Chester Market after arrival at Wigan, and pending the

confirmation of this possibility the Prohibition of Movement Order was modified so as to allow movement by licence in the area referred to, except within a radius of 5 miles of Wigan. This modifying Order took effect on 16th October.

*Summary of Outbreaks.*—(27th August–25th October, inclusive. The following shows the number of outbreaks which have occurred in various counties since the present series of outbreaks commenced on 27th August :—

<i>County.</i>	<i>No. of Outbreaks.</i>	<i>County.</i>	<i>No. of Outbreaks.</i>
Buckinghamshire ...	5	Lincs (Lindsey) ...	1
Cheshire ...	25	Norfolk ...	3
Denbighshire ...	4	Salop ...	14
Devonshire ...	4	Somerset ...	7
Essex ...	5	Staffordshire ...	1
Flintshire ...	9	Surrey ...	3
Gloucestershire ...	1	East Sussex ...	1
Hampshire ...	7	Yorkshire (E.R.) ...	1
Lancashire ...	19	Yorkshire (W.R.) ...	28
		Total ...	138

*No. of Animals slaughtered.*—The total number of animals slaughtered in connection with these outbreaks is as follows :—

<i>Cattle.</i>	<i>Sheep.</i>	<i>Pigs.</i>	<i>Goats.</i>
4,061	5,910	2,532	9

*Compensation.*—The gross compensation (estimated) payable for these animals will amount to about £134,000, but it is estimated that about a quarter of this sum will be recouped by the salvage of healthy carcasses.

*Restrictions on Movement.*—The appearance of fresh centres has necessitated the imposition of restrictions covering the usual 15 miles radius, but as indicated above, this radius had to be extended in the case of Yorkshire, Lancashire and Cheshire, where important markets appeared to have been infected.

*Warning to Farmers, etc.*—The appearance of new centres of the disease of unaccountable origin in widely separated localities is very disturbing, and notices have been issued through the Press and the Branches of the National Farmers' Union, to farmers and dealers in live stock, impressing upon them the importance of keeping a close watch upon their animals and reporting at once to the Police any suspicious symptoms on the mouth or feet of stock. Assistance has also been rendered by the British Broadcasting Co. in bringing to the notice of farmers and others "listening in," through the medium of the wireless news bulletins, the Orders made by the Ministry in certain of the districts. This was notably the case on Saturday and Sunday evenings, 13th and 14th October, in connection with the issue of the Prohibition Order over South Lancashire, Cheshire and North Wales, at a moment when there were the usual week-end difficulties of publishing urgent Orders of this nature.

*Leaflets issued by the Ministry.* Since the date of the list given on page 377 of the July issue of the *Journal*, the following new leaflets have been issued.

- No. 184.—Alsike Clover.
- „ 332.—Carnations.
- „ 399.—Red Clover.



*The following leaflets have been revised.*

- No. 21.—The Warble Fly.
- „ 105.—Wart Disease.
- „ 192.—Farm Butter-making.
- „ 266.—Ropy Milk.
- „ 295.—Marketing of Eggs.
- „ 302.—Silver Leaf Disease in Fruit Trees.
- „ 331.—The Canning of Fruit and Vegetables.
- „ 366.—The Manufacture of Whey Butter.

*The following leaflets have been re-written.*

- No. 182.—Crimson Clover.
- „ 280.—Sainfoin.
- „ 294.—The Housing of Laying Stock.
- „ 317.—The Rearing of Chickens.

**Technical Advice for Farmers.**—The Development Commissioners and the Treasury have agreed to an expenditure of £28,500 in the year 1923–4 on the maintenance of Advisory Officers in entomology, mycology, chemistry, and veterinary science, at the thirteen Provincial Advisory Centres established by the Ministry of Agriculture. These are at Aberystwyth, Newcastle-on-Tyne (Armstrong College), Bangor, Bristol, Cambridge, Cardiff, Newport (Salop, Harper Adams College), Leeds, Manchester, Sutton Bonnington (Notts, Midland College), Reading, Newton Abbot (Devon, Seale Hayne College) and Wye; ten centres in England and three in Wales. At each, there will now be an Entomologist and a Mycologist, and at seven of them there will be Chemists, and at three, Veterinarians. The Centres which are on this occasion having additions made to their staffs under this scheme are Harper Adams College, which gains an Entomologist, Armstrong College, Bristol University, Seale Hayne College, each of which gain a Mycologist, and Armstrong College and Bangor College, which will have new Veterinary Advisory Officers.

This position represents a distinct and noteworthy advance in the scheme for the provision of advice to farmers on technical matters. The organisation of that scheme, as may be remembered, is on the basis of the County, the Province and the Research Station. In the County, the Agricultural Organiser is the chief officer and he is usually in charge of an expert agricultural staff, competent to deal with inquiries from farmers and others on points of recognised agricultural practice. The Province consists of a group of counties ranged round the Agricultural Department of a University or an Agricultural College, the staff of which Department is available for advising agriculturists on the more intricate and difficult problems of agricultural practice. Such advice, however, is usually passed on to farmers through the County Agricultural Organisers. Attached to the University Department or College Staffs are the special Advisory Officers, whose numbers are given above, who devote the whole of their time to the investigation of special problems confronting farmers in the Province and to advising according to the results of their investigations and their knowledge.

**Agricultural Research Scholarships.**—The Ministry, on the recommendation of the Advisory Committee on Agricultural Science, and with the concurrence of the Development Commissioners and the Treasury, has awarded *Research Scholarships*, of the value of £200 per annum, and tenable

for three years, to the following candidates :—Mr. D. I. Evans (University College, Aberystwyth, for Plant Physiology); Mr. I. A. Galloway (Royal (Dick) Veterinary College, Edinburgh, for Veterinary Science); Mr. R. P. Hobson (London University, for Chemistry); Mr. J. P. Maxton (Glasgow University, for Economics); Mr. J. H. Motion (Edinburgh University, for Animal Pathology); Mr. Wm. Williams (University College of North Wales, Bangor, for Chemistry); Mr. S. S. Willimott (Imperial College of Science and Technology, for Chemistry).

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## REPLIES TO CORRESPONDENTS.

**Sainfoin.**—L.N. asks what crops should follow sainfoin and how long before sowing the new crop a sainfoin ley should be ploughed up.

*Reply:* As stated in Leaflet No. 280, barley, on light soils, follows it with great advantage and on thin, dry soils unsuitable for turnips, rape and mustard often follow sainfoin successfully. On other soils there is a wider choice, but it is advisable to select a crop less susceptible to wireworm which is usually rather prevalent in a ploughed up sainfoin ley. Wheat, for this reason, is not often taken after sainfoin, but it is not unusual after ploughing up the ley in the autumn and leaving it to weather during the winter to sow oats in the spring. In that case the application of manures at seed time will generally carry the crop over the danger of wireworm attack. Beans are also taken after sainfoin and also, if the soil is suitable, turnips or potatoes. At any rate the ley should be ploughed up as early as possible and left during the winter.

**Farm Values of Home Grown Feeding Stuffs.**—B.A. asks how to work out farm values of cabbages and beans.

*Reply:* The method of working out the food values per ton is partly explained in Leaflet No. 396. For hay and straw, however, instead of taking the (starch equivalent) unit value for maize, the unit value for dried brewers' grains is taken. For vetch and oat silage the average between the two (maize and dried brewers' grains) is taken. The manurial values are based on figures in Bulletin No. 73 of the University of Leeds and the Yorkshire Council for Agricultural Education. The starch equivalent is taken from column 15 (net digestible energy as starch) in the Ministry's Miscellaneous Publication No. 32 ("Rations for Livestock"). The protein content is not used in estimating cash values but, as explained in Leaflet No. 388, needs to be considered in compounding rations.

**Moisture Content of Cereals.**—C.B. asks what is the moisture content of cereal grains.

*Reply:* Figures for the average marketable product, given in the Ministry's Miscellaneous Publication No. 32 ("Rations for Livestock") are between 13 and 15 per cent. At the time of threshing the figure is very variable. It may be over 20 per cent. if the crop has been got in under bad weather conditions or it may be about 13 per cent. Afterwards the figure varies with the weather and in a damp spell the grain can easily absorb a few per cent. of moisture.

**Eradication of Fleabane.**—D.C. asks for information.

*Reply:* Common Fleabane (*Pulicaria dysenterica* Gaertn.) grows on moist road sides, ditch banks and badly drained pastures and increases chiefly by



means of a creeping root-stock, which is not extremely deep-seated. Occurring as it does on clayey soils or on sandy soils over clay, thorough drainage is of great value in its eradication. Persistent cutting with a scythe (see paragraph 4 (b) on page 5 of Leaflet No. 112) will greatly weaken the plants by preventing the storage of food for future use. Ploughing up and cultivation of an infested field offer the best chance of permanently cleaning the land.

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## NOTICES OF BOOKS.

**The Journal of the National Institute of Agricultural Botany. No. 1, 1922.**—(Published by the Institute, Huntingdon Road, Cambridge, price 1s.) The appearance of this new Journal is the result of a decision of the Council of the Institute to collect in one annual publication the reports of all scientific work carried out by the different branches, and to include a brief statement of the proceedings of the Fellows of the Institute. The Journal includes the reports of trials carried out in 1922, together with the reports of the Official Seed Testing Station for England and Wales and of the Potato Synonym Committee, which have been hitherto published separately. The present publication will appear every spring, while the Annual Report of the Council and the Accounts will continue to be issued in the autumn.

**Elementary Agricultural Science.**—(William Smith. London: Oliver and Boyd.) This little book extends to about 175 pages and contains 61 illustrations. It deals with agricultural science in a simple manner, to meet the needs of pupils who are still at school and require guidance of a more elementary character than is supplied in the many existing good books of a more advanced type. It is really a suggestive outline of principles, intended to inspire the pupil with a wish to learn more about agriculture. To this end it deals briefly with soils and their cultivation, the plant and its growth, manuring, the various crops, rotations, crop diseases and pests, and weeds of the farm. At the end of each chapter is given a short series of questions which the pupil can usefully set himself to answer. Mr. Smith's work can safely be placed in the hands of young people between the ages of 9 and 18.

**Guide to Current Official Statistics.**—(First issue, 1922, pp. 162, H.M. Stationery Office, price 1s.) This guide has been prepared at the instance of the Permanent Consultative Committee on Official Statistics, and aims at enabling persons who are using these statistics to ascertain readily what has been published during the year on any particular subject.

The guide is divided into two parts: (1) a list of publications containing statistics grouped, usually, under the respective public departments, and (2) a subject index to the publications included in (1). In addition to this, by a system of cross reference under the main headings of the subject index, a ready means is provided of tracing a publication on a relatively minor subject. In an introduction general instructions for using the guide are given.

This book and the subsequent issues will be a great assistance, indeed a necessity, to those engaged in statistical research or to others whose work involves the consultation or use of official statistics.

**The Farmer's Raw Materials.**—(James Hendrick. Edinburgh : W. Green & Son, Ltd., 1923, 211 pp., 6s.) This is the second of the new Scottish Series of Junior Agricultural Text-books, of which *Farm Book-keeping* by John Kirkwood has previously appeared, while *Dairy Farming* by Professor R. H. Leith will follow shortly. It is pointed out in the general preface that while higher agricultural students of University standard are well supplied with excellent text-books, few up-to-date manuals exist which are suitable for students of the intermediate grade attending Farm Institutes, extension lectures at agricultural colleges, or similar courses. While the series is intended to have as its viewpoint the agricultural and educational conditions peculiar to Scotland and the north of England, the bulk of the material will be of general application, and to judge from the standard of the two books already issued, there is good ground for the hope expressed that the publications will be found useful further south.

The author of this simple but informative account of the farmer's raw materials—air, water, soil and manure—who is also the general editor of the series, is too well known by his work at Aberdeen University for this small work to need any special recommendation. Suffice it to say that the book is intended to convey in a simple, readable manner such knowledge as is necessary to the farmer in order that he may use to the best advantage his four primary raw materials. The subject of manures, the importance of which is especially emphasised, receives particularly full treatment. The use of a certain number of chemical terms has necessarily been unavoidable in a work of this kind, but they have been limited as far as possible to those which should be familiar to every farmer and to the average boy who has received a modern elementary school education.

**Foundations of Agricultural Economics**—(J. A. Venn, M.A., Cambridge University Press, 1923, pp. 397, 16s. net.) This book might, perhaps, have been more fitly entitled "*The Historical Foundations of Agricultural Economics*," for it is the foundations in history, rather than in economics, with which it deals. Thus in the two chapters on that important subject in the economics of agriculture—the size of holdings—the treatment is mainly of an historical or generally descriptive character, only a few pages being concerned with this question in relation to cost of production or to other economic aspects of the subject. Similarly, the sections dealing with the fluctuations in agricultural prices between 1914 and 1922, although giving a general account of the rise and fall in prices, are almost without a reference to the fundamental economic theories, upon which such price movements are now generally believed to depend. But these are slight criticisms of a book so admirably arranged and so full of information as this is; nor can we pass over the question of the size of holdings, without reference to the extremely interesting section and tables dealing with the relative yields from large and small farms in Rumania, the only country in Europe to compile such statistics.

The book has one great merit—it is very readable. The first two chapters give a concise and attractively written account of the various systems of land tenure from the earliest times down to the present day, and the chapters dealing with "Tithe" and "Land Tax, Rates and Income Tax" are both excellent and informative. It is, perhaps, to the chapters on "Agriculture in



Peace and War," and "The Wheat Supply of the United Kingdom," that the reader will turn with most interest. In the former, an account of the "ploughing up campaign" undertaken by the Food Production Department, with a description of the organisation, and an analysis of its effect, is given. It is followed by a discussion of the difficulties of maintaining the increased arable area thus brought into being, after the fall in prices, which began in 1920, had set in. In the chapters on the wheat supply, a short historical survey is followed by an historical account of the various attempts that have been made to maintain corn prices by legislation, and the circumstances which led to, and the results which followed, the repeal of this legislation.

An excellent account of Agricultural Co-operation is given in a chapter on this subject, comparing the widely different forms co-operation has assumed in different countries.

A chapter on agricultural statistics, again treating the subject from an historical point of view, and some useful appendices, conclude this admirable and scholarly book.

**Farm Live Stock of Great Britain.**—(Professor Robert Wallace assisted by Professor J. A. Scott Watson. Edinburgh and London: Oliver and Boyd, 5th Edition, 1923, 868 pp., 30s. net.) The new edition of this widely appreciated work, which deals with the most important section of our farming system, is notably issued in the joint names of two successive Professors of Agriculture at Edinburgh University—the first British University to grant a degree in agriculture. Though it extends to 868 pages and contains 442 plates and 111 text figures, it is not to be regarded as containing an exhaustive account of every breed. It does, however, give such an account of all breeds of horses, cattle, sheep, goats, pigs and sheep dogs as will suffice to meet the needs of most farmers and students, and is undoubtedly the finest single volume of its type published within the Empire.

As an example it may be remarked that Devon and South Devon cattle are dealt with in 9 pages, consideration being given to origin and history description, distribution, economic value for beef and milk, and prominent breeders. The principles of live stock breeding cover 18 pages; the breeds of cattle 230 pages; such matters as calves, grazing cattle and their diseases, house-feeding of cattle, dairying and management of dairy cows, 125 pages. Other classes of farm live stock are dealt with on similar generous lines, and there are numerous appendices of considerable value and interest. The illustrations are, in the main, of the highest degree of excellence, but in a few cases—as is so common in photography of this class—the animal is placed before a bad background which breaks the outline and renders it indistinct. Altogether this volume can safely be regarded as a sound work of reference.

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# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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DECEMBER, 1923

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## NOTES FOR THE MONTH.

SIR ROBERT SANDERS, Minister of Agriculture, outlined the agricultural policy of the Government at a meeting at Cirencester on the 15th November, 1923. He said, if returned to power, the Government proposes to give a subsidy of £1 an acre on all arable land to occupiers of holdings of more than one acre in extent. Market gardens and land under fruit and hops are included. One of the main objects of the subsidy is to prevent increasing unemployment, and the consequent fall in wages. It will, therefore, not be given to any farmer who pays a wage of less than 30s. a week to able-bodied adult workers. When wages rise above that minimum, it is confidently hoped and expected that the labourers will, in the ordinary course, obtain in their wages their share in the benefit of the subsidy.

### **Government's Agricultural Policy.**

“In this regard it rests with the farmers to prove in practice that wages boards are unnecessary for that purpose. But the Government must reserve the right in cases of necessity to establish machinery to ensure that a fair wage is paid. This is not the time to go into details, but I ought to say that it will be necessary to make provision to prevent rents being raised on account of the subsidy. That raises the question whether, if a subsidy is given, it should be given upon acreage or upon the amount of production.

“The Government have decided, and, I think, rightly, in favour of giving it for acreage, because, if you give it according to the amount of production, then the man who is cultivating the best land, and consequently gets the best crops, gets the greatest advantage. What we want to do is to keep the poor land under the plough, and it is only by making this arrangement upon the basis of acreage that you can ensure that being done. This scheme ensures the minimum of Government control. The Ministry of Agriculture have had considerable experience in this matter of inspection and Government control, and

they have deliberately arrived at the conclusion that a subsidy on the basis of acreage leads to very much less control and interference than a subsidy on the basis of production.

“ We all hate inspection and control. We all hate seeing Government officials about the place. We believe that such a system as I have foreshadowed is the system by which you can best give real assistance to arable cultivation, and at the same time ensure the minimum of red tape.”

Sir Robert Sanders said there was a measure in connection with which he had come in for a considerable amount of criticism, and that was the proposal to put a duty on imported malting barley. When Mr. Bonar Law was Prime Minister that was announced as part of the policy of the Government. Their intention then was to put an Excise duty, a duty collected within the country, upon imported malting barley. It was ascertained that there were certain treaties with foreign countries which prevented them from doing that at once. They then set to work to see whether they could not do it by means of a Customs duty, and the Committee which had lately been sitting had found a way, and one which he thought was workable, practicable, and satisfactory, in which they might impose that duty by means of a Customs instead of an Excise duty, and it was the intention of the Government, if returned, to put a Customs duty on malting barley.

\* \* \* \* \*

THE recommendations made in the First Interim Report of the Agricultural Tribunal of Investigation were summarised in this *Journal* for May last. p. 110.

**The Second  
Interim Report of  
the Agricultural  
Tribunal.**

The Tribunal was appointed on 29th December, 1922, “ to inquire into the methods which have been adopted in other countries during the last fifty years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labour at a living wage, and to advise as to the methods by which those results can be achieved in this country.”

The Second Interim Report\* was issued on 17th November. It recalls that the decline in the arable area is no new thing, as, with the exception of the years 1916-1920 and save in individual years, there has been a steady decline during the last fifty years. In 1873 the arable area in Great Britain was 19,196,671 acres; in 1923 it is 14,478,013 acres, a decline of

\* H.M. Stationery Office, Cmd. 2002, 3d. net.



3,708,658 acres, or 20 per cent. A great part of this decline is due to a shrinkage of over 48 per cent. in the wheat area. The movement shows no sign of slackening. The Tribunal state that they would view with grave concern any substantial decrease in the present arable acreage of the country, since the maintenance of that area is an important factor in the maintenance up to pre-war level of the home production of food, and of the employment of labour.

The Tribunal express the view that "if the decline in the arable area is to be at least checked, immediate direct action by the Government is necessary. If left to itself the farming industry will necessarily adjust its practice so as to make farming pay. But under present circumstances it will be farming of a character which will involve a material reduction in the supply of home-grown food and a serious decline in the number of men employed on the land, thus adding yet further to the burden of unemployment." They come definitely, though reluctantly, to the conclusion that, in order to maintain the agricultural area, either a guarantee or a subsidy would be necessary.

Discussing the question of a subsidy or guarantee the Tribunal point out that the unequal incidence of a subsidy is inherent in any scheme that may be devised. They suggest alternative methods:—(1) a subsidy on each acre of arable land in excess of 12,000,000 acres, this being the arable acreage below which the total in Great Britain is not likely to fall; (2) a subsidy of £1 per acre on the whole arable area; (3) a guaranteed price to the farmer for his wheat—a subsidy on output; (4) an acreage subsidy on wheat, thus not penalising poor land; (5) a subsidy on wages by a contribution from the State to the farmer's labour bill; and (6) that land under the plough should be given assistance through partial relief from national taxation. Discarding certain methods as being administratively difficult, or unequal in their incidence, or encouraging all types of farming instead of arable farming in particular, the Tribunal prefer a scheme which combines a subsidy on all arable land with an additional subsidy on land under wheat. They therefore recommend a subsidy of 10s. per acre on all arable land as defined (that is, all land ploughed during the year, including summer fallow, but excluding land under clover and grass seeds, small fruit, orchards and hops) and an additional subsidy of 10s. per acre on all land under wheat.

In making their recommendation the Tribunal are of opinion that "in order to place a premium on good farming the Minister of Agriculture should have power to reduce or withhold altogether the subsidy in cases where he is satisfied that the farmer has not cultivated his holding according to the rules of good husbandry as defined in the Agriculture Act, 1920, and we consider that the County Agricultural Committees should be charged with the duty of furnishing the Minister with the necessary information."

The Tribunal renew and emphasize the recommendations in their First Interim Report with regard to the creation of district Agricultural Wages Boards, as they "could not contemplate a subsidy to agriculture unless a considerable portion of the benefit thereby accruing to the industry was in fact enjoyed by agricultural workers."

\* \* \* \* \*

THERE is a great need for an increase in the number of pigs kept in this country, and particularly of high-grade bacon pigs.

**Pigs for Bacon.** In order to create an interest in this side of farm produce, a number of articles have been published in this *Journal* in recent months. In this issue appear two such articles, one of which is especially devoted to the production of bacon pigs. It is hoped that the latter is a sound statement of what most farmers need to know regarding the points of a bacon pig, and that with this before them they will have less difficulty in producing what the curer wants. It is not a question of breeding an improved variety of pig: the Danes, so often held up as models, use British pedigree boars for producing their bacon pigs. Nor is it a question of nature of food, for the Danish pig is fed on standard lines—largely with foreign barley. Yet the difference in the results is striking.

The view is held that, whereas at least three-quarters of the Danish pigs give first quality bacon, less than one-quarter of the English pigs reach that standard.

It would appear that the Danes secure their results by the adoption of the following methods:—

1. Concentration on the single aim of producing a side of bacon pig for the English market, without considering the pork pig.

2. The co-operative and State control of the whole business from start to finish. Beginning with the boars, they do what is in accord with modern views on genetics. For example, boars whose progeny do not come up to a certain standard are



slaughtered. In other words, the test applied is *progeny*, not pedigree. Further, the standard is not a fancy one based on external points. It depends mainly upon precise measurements of the carcass, and consideration is given also to such matters as early maturity, capacity of flesh to take up salt readily, distribution of fat and lean.

It is clear that the Danes have succeeded because they have organised the whole business of bacon production, from breeding to curing and marketing. In this country there is a lack of unity of aim or effort. Some farmers aim at producing the "porker," and only carry it on to bacon weights when the pork market is bad. Others are thinking of the pedigree trade, and "points" have too often been determined by the fancy of judges and breeders without sufficient consideration of the economic aspect of the carcasses.

Some excuse for the farmers' attitude, however, is to be found in the confusion between the requirements of pork butcher and bacon curer respectively, which have not been clearly defined in the markets. Again, bacon curers have not always paid a better price for the good bacon pig. As Professor Wood pointed out in the course of a discussion at Cambridge last May, the farmer is insufficiently in touch with the consumers' market. Just as Professor Biffen made an advance in wheat breeding by consulting the miller, so progress in other branches of technical knowledge will be promoted by co-operation with persons engaged in the actual businesses which handle the farmers' raw materials.

The conclusion of the whole matter seems to be that there is one procedure which may go a long way to remedy the existing state of affairs. We need more standardisation of our production. What the English market requires and appreciates is *a regular supply of a standard product*—whether it be cheese, butter, fruit, bacon or corn. It is the finest market in the world. The irony of the position is that the best English produce is still superior to anything coming from abroad. The best Wiltshire bacon still commands the highest price, but no one can undertake a future delivery of regular supplies of uniform quality. Yet as Mr. J. M. Harris has pointed out, the Danes can contract to supply sides by the thousand, all of one quality. Co-operative societies, after all, are only methods; it is organisation, and the common purpose inspiring and actuating the whole mechanism of production and supply that count.

THE Annual Report of the Official Seed Testing Station will be published by the National Institute of Agricultural Botany in its Journal for 1923, which will be available early in the New Year. The following notes summarise the results during the season ending 31st July, 1923.

**Official Seed Testing, 1922-23.** The number of samples received for testing was 21,678, which is a considerable reduction on the figures for 1921-22. The reduction occurs in the number of samples received from seed firms, there being little change in the number received from farmers. The decrease is particularly noticeable in the case of red clover seed, the samples of which were 50 per cent. fewer than in the previous season. The main points of interest are as follows:—

*Cereals.*—Owing to the adverse harvest conditions in 1922 an increased number of samples showing low germination was received. This resulted in a decrease in the general average, which was especially marked in the case of oats, of which no less than 17.3 per cent. of samples germinated below 85 per cent., as compared with only 7.5 per cent. below that figure in 1921-22.

The number of samples showing indication of disease was, however, noticeably less. In the case of wheat 15.7 per cent. of the samples contained bunt, and 2.8 per cent. showed traces of earcockles, as compared with 33 per cent. and 9 per cent. respectively in 1921-22.

*Pulse.*—The germination of field beans and vetches has been considerably lower than usual. Vetches in particular were of poor quality, over 50 per cent. germinating below the minimum percentage scheduled in the Seeds Regulations.

*Roots and Vegetables.*—Owing to the unfavourable harvest conditions the germination of most of the root and vegetable seeds was somewhat below the average of recent seasons. Onion and carrot, however, show a slight, and parsnip a very considerable, increase in percentage germination over last season.

*Clovers.*—New Zealand seed shows the highest purity and germination. It is unfortunate, however, that more attention is not paid to the removal of the small-seeded dodder from this seed. Alsike was of average quality, but mid-European samples produced better figures than usual.

Lucerne, trefoil and crimson clover showed figures very similar to the previous seasons. White clover, however, averaged rather higher germination, but lower in purity. Wild white clover con-



tained a larger percentage of impurities than usual. Sainfoin showed a marked drop in both purity and germination.

*Grasses.*—Perennial ryegrass was of average quality, but Italian ryegrass was below the average. It is worthy of note that over 50 per cent. of the Italian ryegrass samples contained 1 per cent. or over of injurious weed seeds, whereas this figure has previously never exceeded 40 per cent. Cocksfoot was of rather better quality than usual, and particularly free from injurious weed seeds. The average purity of meadow fescue and dogstail also showed an appreciable increase. Timothy was of average quality. Other grasses call for little comment; they all show a high percentage of impurity, but this in all cases consisted almost entirely of chaff.

An account of the administration of the Seeds Act, 1920, during the year 1922-23 will be found at p. 822.

\* \* \* \* \*

SEEDS are perhaps more variable in quality than any other goods the farmer has to purchase. The *purity* of seeds varies

**Farmers and the  
Seeds Act, 1920.**

according to the manner of growth of the seed crop and the methods of harvesting and cleaning it, and the *germination power* varies with the weather during the period of growth—especially at the time of harvesting—as well as with the method of harvesting and storing.

The Seeds Act, 1920, makes it compulsory in the case of a sale of any of the principal kinds of grass, clover, field or garden seeds, for the seller to state in writing certain essential particulars as to the quality—including the percentage purity, percentage germination, and the presence of injurious weed seeds.

Farmers, when buying their seed, should ensure that they receive this statement, to which they have a statutory right.

It is most important for farmers to note that in selling seed corn, or any of the scheduled kinds of seeds intended for sowing, such as red clover, tares, etc., they are in precisely the same position as a seedsman, and are bound to supply the same guarantee. Thus, a farmer selling a sack of home-grown clover seed to a neighbour for sowing must, in the first place, have a sample tested, and supply the buyer with a copy of the result not later than the date on which the seed is delivered. Any farmer can have the required test made at the Official Seed Testing Station, Huntingdon Road, Cambridge.

Further information as to the particulars required to be declared, and of the fees charged at the Official Seed Testing Station, are given in Circular No. 728/C.S., copies of which may be obtained free on application to The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

\* \* \* \* \*

IN the June number of this *Journal* an article entitled "Village Life and Country Industries" was prefaced by a paragraph in which it was explained that the article was the first of a series on Rural Industries which was in course of preparation by the Rural Industries Intelligence Bureau. It was intended that all

these articles should first appear in this *Journal*, but would be subsequently available in the form of reprints on application to the Bureau.

Since the issue of that number, which also contained a shorter article entitled "Hurdle Making by Machinery in North Wales," other articles on rural industries have been published herein. It has subsequently transpired, however, that the Bureau, in view of the large amount of information which is now reaching it on various subjects, has found it impossible and undesirable to attempt to compress these articles within such uniform limits as would make their inclusion in the *Journal* possible. For reasons of space, therefore, it has proved impracticable to include in the *Journal* certain articles on subjects which are not of general interest to the farming community. These articles have consequently been issued directly by the Bureau in printed form and uniform with the reprints of articles from this *Journal*.

The practice of including articles in the *Journal* nevertheless will continue to be followed as far as possible (*vide* "Mat Making" in the present number), but it may be desirable at this stage to furnish, for the benefit of interested readers, a list of leaflets issued up to date. In the following list, leaflets marked with an asterisk have already appeared in these pages:—

- \* Village Life and Country Industries (Leaflet No. 1).
- \* Hurdle Making by Machinery in North Wales.
- \* Straw Ropes and Straw Envelopes (Leaflet No. 2).
- Peat Firelighters (Leaflet No. 3).
- The Village Blacksmith and His Outlook (Leaflet No. 4).
- \* Walking Sticks (Leaflet No. 5).



Suggestions and Opportunities for the Rural Woodworker (Leaflet No. 6).

Handloom Weaving and Handspinning (Leaflet No. 7).

\* Matmaking (Leaflet No. 8).

Compressed and Composition Firelighters (Leaflet No 9).

Copies of all the above can be obtained on application to the Rural Industries Intelligence Bureau, 258-262, Westminster Bridge Road, London, S.E.1.

\* \* \* \* \*

AFTER rising slowly for three months, the general index number of the prices of agricultural produce fell sharply in

### The Agricultural Index Number.

October, owing mainly to the much lower level at which hay of this season's crop is selling as compared with the prices of the 1922 crop. There was also a sharp fall in the index number for fruit, which is now based on apples only, whereas in September plums and pears, which were relatively very dear, were on the market. The general index number for October is 51 per cent. above pre-war, and is thus back at the same level as in June, and is 5 per cent. lower than a year ago.

The following table shows the percentage increase in each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ... ..	200	183	75	68
February ... ..	195	167	79	63
March ... ..	189	150	77	59
April ... ..	202	149	70	54
May ... ..	180	119	71	54
June ... ..	175	112	68	51
July ... ..	186	112	72	53
August ... ..	193	131	67	54
September ... ..	202	116	57	56
October ... ..	194	86	59	51
November ... ..	193	79	62	—
December ... ..	184	76	59	—

The average price of wheat remained unchanged at 8s. 11d. per cwt., but as there was a slight fall in October in the pre-war period, the index figure advanced by one point. Barley declined by 3d. per cwt. and oats by 1d. per cwt., against a rise of 2d. per cwt. between September and October, 1911-13, and the index number in each case declined by 5 points to 25 per cent. above pre-war. As compared with a year ago each cereal is cheaper by 3 to 6 per cent.

Most of the hay on the market during October was of this season's crop, and no doubt owing to the heavy yields this year, prices of new hay are much lower than those which have ruled for old hay. Clover hay is realising about 13 per cent.

more than in 1911-13, whilst meadow hay prices are at the pre-war level, hay being now relatively cheaper than any other class of agricultural produce.

Following the sharp fall in the latter half of September, potato prices have been fairly firm throughout October, and during the last two weeks a hardening tendency was in evidence. The index figure, however, shows a decline of 13 points on the month, the average price in October being 62 per cent. above pre-war, which compares with only 3 per cent. above in October, 1922.

The price of fat cattle has varied very little since the middle of August, and during October averaged 44 per cent. above 1911-13, or a little over 3 per cent. less than a year ago. Fat sheep prices have hardened during the last three weeks, and averaged 76 per cent. above pre-war in October, a rise of 4 points on the month. Fat pigs, on the other hand, which have been in large supply and affected by the decline in the price of bacon, have become cheaper, and declined by 7 points on the month to 48 per cent. above 1911-13. A year ago fat pigs were selling at 85 per cent. above pre-war prices.

As is usual in October the price of dairy cows advanced, but this year the rise was sharper than before the war, and the index figure rose from 52 per cent. to 61 per cent. above pre-war. The markets for store cattle have been disorganised in some districts by foot-and-mouth disease restrictions, but with the autumn demand increasing, prices have hardened somewhat. The rise has, however, been relatively the same as before the war, and the index figure remains unchanged at 27 per cent. above 1911-13. Store sheep were also dearer in October, but the rise was not so great as usual, and the index number shows a fall of 10 points to 99 per cent. above pre-war. Prices of store pigs have declined in sympathy with those of fat pigs and were 82 per cent. above 1911-13 in October against 95 per cent. above in September. It may be mentioned that the index figures of dairy cattle and store stock are not taken into account in calculating the general index number for all classes of agricultural produce, as store stock when sold simply pass from one farmer to another.

Winter milk prices came into effect at the beginning of October, and the average contract price in October was 72 per cent. above pre-war; a year ago the increase was 90 per cent. In the case of both butter and cheese the rise in price in October was sharper than usual, and the index figure for butter advanced



by 5 points and for cheese by 2 points on the month. Cheese is 36 per cent. dearer than in October, 1922, but butter is 6 per cent. cheaper. Eggs are now very dear, and during October averaged 92 per cent. above pre-war, but were 6 per cent. cheaper than a year earlier.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922.			1923.		
	Oct.	June	July	August	Sept.	Oct.
Wheat ...	24	38	39	29	19	20
Barley ...	29	17	12	9	30	25
Oats ...	33	41	41	30	30	25
Fat cattle ...	49	52	45	46	45	44
Fat sheep ...	90	83	72	76	72	76
Fat pigs ...	85	69	54	52	55	48
Dairy cows ...	69	50	49	51	52	61
Store cattle ...	30	31	28	28	27	27
Store sheep ...	106	114	109	101	109	99
Store pigs ...	135	130	113	102	95	82
Eggs... ..	104	40	36	68	75	92
Poultry ...	77	87	79	61	67	65
Milk ... ..	90	53	57	67	67	72
Butter ... ..	71	33	37	48	56	61
Cheese ... ..	36	44	54	67	74	76
Potatoes ...	3	—31*	66	80	75	62
Hay ... ..	45	42	38	34	32	7

\* Decrease.

\* \* \* \* \*

THE agreement of the Cheshire Committee, which was due to expire on 31st October last, has been extended up to 30th April,

#### Conciliation Committees in Agriculture.

1924. The terms provide for payment to adult male workers at the rate of 32s. for a 54-hour week, with overtime at 9d. per hour.

The Lancashire Committee has decided to extend the period of operation of its last agreement from 31st October last to the end of January, 1924. The weekly rates of wages for adult male workers for the normal working hours are as follows:—Southern Area: special classes 35s., other workers 32s. 6d.; Northern Area: special classes 37s. 6d., other workers, 35s.; Eastern Area: special classes 40s.

The Committee for Shropshire has also agreed to maintain wages at their present level, the agreement due to expire at the end of October last having been extended up to 1st March, 1924. The rates are 30s. for a guaranteed week of 54 hours for able-bodied adult male workers, and 9d. per hour for Sunday work.

\* \* \* \* \*

## THE BACON PIG.

There is in this country a large demand for bacon of the best quality—a demand which is at present inadequately satisfied by the British producer. There has been a considerable expansion in pig-breeding since the War, but the output as yet does not even meet the demand for fresh pork, still less for pigs to be converted into bacon. The rearing of pigs offers one of the most remunerative opportunities open to the British farmer, and is still capable of great expansion, especially in view of the low prices ruling for cereals and other farm crops upon which the pig may be fed.

It is not the purpose of this article to discuss the various alternative methods of pig-keeping that may be adopted or the relative advantages of pork and bacon production. These must be determined by the conditions of the farm and the local market. The farmer who sets out to produce bacon pigs should breed and feed with the object of turning out a uniform product of the type that can be converted into first quality bacon with the least amount of waste. It may be emphasised that a pig suitably bred for the bacon manufacturer is usually an excellent pork pig; but it does not follow that a pig which may be killed for pork is of suitable structure for first quality bacon.

Strong representations have been made to the Ministry by the bacon curers that they are unable to obtain sufficient pigs of the right quality to enable them to keep their businesses running at full power, and that in particular they receive an undue proportion of pigs which cannot be converted into first quality bacon. It is stated that in other countries, notably Denmark and Sweden, where pig rearing has been organised for the production of bacon, as many as 75 per cent. of the pigs sent to market are convertible into first-class bacon, largely as a result of aiming at a standard type, whereas in England, doubtless partly owing to the numerous breeds and crosses, the proportion is no higher than 25 per cent. A large proportion of the pigs in the remaining 75 per cent., although of good quality, are too fat and heavy for first-class bacon.

In some respects the responsibility for this undesirable state of things rests with some of the bacon curers who have paid upon a basis of weight alone without reference to the suitability of the carcass for bacon production, but the Ministry is aware that certain firms of bacon curers have now become



selective in buying and are adopting an improved method of payment.

The Ministry considers that the development of the bacon industry and the production of the right type of bacon pig will depend upon the financial inducement offered to the farmer by the bacon curer for the supply of graded pigs at recognised graded prices. The farmer, too, should realise that by helping forward the bacon industry he is stabilising prices for himself. The producer, the curer and the retailer are all equally interested in the industry, and equally responsible for increasing and improving the supply of English bacon. They are, in fact, partners, and the interest of each is bound up with that of the others, and close co-operation between them is essential.

**The Bacon Pig.**—The ideal bacon pig should conform to the following standard :—

1. *Back.*—Long and level, with ribs well sprung.
2. *Sides.*—Level and moderately deep.
3. *Hams.*—Broad, wide and deep to hock. Tail set high.
4. *Belly and Flank.*—Thick with straight underline.
5. *Shoulders.*—Light, and on a line with forelegs below and with sides laterally. Free from wrinkles and coarseness.
6. *Flank.*—Aligned with the sides.
7. *Head, Neck and Jowl.*—Light.
8. *Legs.*—Short, and set wide apart. The pig should stand well up on the tips of the toes.
9. *Bone.*—Fine.
10. *Flesh.*—Firm, without excessive fat.
11. *Skin.*—Free from coarseness and wrinkles.
12. *Hair.*—Fine.

There should be no rolls of coarse fat at the jowl or over the neck, and no depression between the hams at the root of the tail, as this indicates excessive fat. The pig should be full and firm behind the elbow, and the flank, which should be thick, should handle firm. The streak cannot be too thick so long as there is a proper proportion of lean to fat. The fat part of the back should never exceed  $2\frac{1}{2}$  in. in thickness, and may be as little as  $1\frac{1}{2}$  in. in thickness. Fineness of bone is of great importance.

The size calculated to produce the best price is the medium bacon pig producing sides when cured of 56-65 lb. in weight, i.e., a pig approximately 220 lb. live weight or 160-165 lb. dead weight. Such pigs should be ready at about seven months old. Heavier pigs, up to 260 lb. live weight, find an outlet in the Midlands and the North, and many are absorbed by the ham and cutting trade, the loin being sold for pork and the hams and bellies cured for bacon. Animals over 260 lb. live weight are not likely to sell at higher prices than fat sows. The

farmer should acquaint himself with the weight desired by the bacon curer with whom he deals.

**Breeds and Breeding.**—The ideal bacon pig can be raised in many ways from the various English breeds. It is generally agreed that the bacon type of pig can best be obtained as a first cross, using one of the large breeds to attain length of side. It is rarely wise to go beyond the first cross, as with a second cross the progeny often fail in uniformity of type. As an example of a suitable cross, many rearers of bacon pigs use Large White boars for their length of side, with a Middle White sow to secure more rapid growth and a better ham and streak. A cross the other way about also makes a very good bacon pig. The bacon pig can, however, be obtained from other breeds and crosses provided that the breeder keeps in mind the type outlined above. Owing, however, to the presence of black pigment in the mammary glands of certain races of black pigs, producing the so-called "seedy cut" in the streaky, wholly black pigs should be avoided, unless, as seems possible, strains can be selected which do not show "seedy cut." The progeny, however, of crosses when one parent is pure white rarely show "seedy cut"; for example, Large Black sows crossed with a Middle White boar, or Large White over Berkshire yield pigs which are mostly white or blue and white and are less likely to show "seedy cut."

**Feeding.**—The feeding of pigs for bacon is not dealt with fully here. It will be sufficient to emphasise the fact that bacon pigs should not be too fat but should show a good proportion of lean, and that foods tending to produce soft fat should be avoided. An excess of swill or too much maize or linseed tends to produce an undesirable quality of fat. The use of fish meal is risky. Fish meal should only be employed when the farmer can make certain (1) that he obtains the right kind of white fish meal; (2) that the man in charge of the pigs will only feed to each pig the strictly limited amount which can safely be fed without tainting the flesh. Even this limited use of fish meal is undesirable after the pigs reach about 100 lb. live weight, but in any circumstances the use of fish meal should be discontinued four weeks before the pigs are sold for slaughter. The use of the wrong kind or of an excessive quantity of fish meal, or fish meal used too close to the killing time results in a taint in the flesh of the pig which renders it absolutely unfit for bacon. Cod liver oil is perhaps even more dangerous.

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## PIG-KEEPING.

## IV.

W. A. STEWART, M.A., B.Sc. (Agr.),  
*Northamptonshire Farm Institute.*

*Selection, Feeding and Management of Breeding Stock;  
Open air Pig-Keeping on Grass and Forage Crops;  
Supplementary Rations; Methods Employed in Folding.*

**Selection of Breeding Stock.**—In purchasing their foundation stock, there are several courses open to those starting pig-keeping. Pigs can be bought in the ordinary market, or at pedigree pig sales, or privately. The first method is least to be recommended, because the buyer is usually unable to learn enough about the pigs' ancestry. He does not know whether they may or may not have been in contact with disease. He may not even know the farm from which they have come, and it is important that he should have information on these points. For those reasons private purchase from reliable sources is perhaps most satisfactory.

At pedigree stock sales, pigs are often offered in very fat condition. Superfluous fat fills up many hollows and smooths down many humps, and with an outside covering of fat, pigs can be made to look attractive to would-be purchasers. Certain buyers are impressed by the size and apparent substance of fat heavy animals and good prices have been obtained for them. In addition to obscuring faults, superfluous fat has other disadvantages. If deposited in excess in the reproductive organs, it may seriously impair the breeding capacity. If deposited in the udders of females, it may interfere with milk production. If a sow farrows in this over-fat condition she is much more likely to be lazy and clumsy and to lie on her pigs. The practice of offering very fat pigs at sales of breeding stock should be discouraged.

A clever judge can recognise a good pig even when it is in "the rough" or in ordinary breeding condition; a poor judge can only appreciate an animal when it is fat. The services of the former may be very helpful to a beginner in choosing his foundation stock. It should be clearly understood that there is a difference between "fatness" and "fitness." A well-bred pig which has been suitably fed and managed will have that "fit." attractive appearance which is secured by an even covering of firm flesh and by that nice "bloom" of coat and

skin which is associated with good health and vigorous and sound digestion.

Animals intended for breeding should be selected from uniform good sized litters. The dams should be good milkers, and healthy, good tempered and careful mothers, active foragers and typical of the breed to which they belong.

If possible, the purchaser of breeding pigs should see their sire in order to learn whether he is a good specimen of his breed. He should also see as many of his litters as possible, to enable him to form an opinion as to his breeding capabilities. The progeny of a coarse, strong-boned, rough boar should be avoided, as it is possible they may be deficient in quality and lack early maturity.

Gilts selected for breeding should have not fewer than twelve teats, and they should have a reasonable standard of weight for age, taking into consideration the amount and nature of the food which they have been receiving. If possible, gilts of sixteen weeks old or upwards should be selected, because with younger animals it is more difficult to form a reliable idea as to how they are likely to develop. In-pig gilts are usually a good investment as they are near profit, and yet have the whole of their productive lives in front of them.

At sales the older sows are sometimes well worth the money they realise, and if one can find out beforehand what sort of breeders they have been, and if their udders are still sound, they may prove an economical purchase. On the Moulton Experimental Farm an old sow born in 1916 reared litters up to 1923, and another born in 1918 has reared twenty-seven pigs in her last three litters. It is a common opinion that sows should be discarded for breeding after their fourth litter, but provided the sow is breeding well, it would seem advisable to breed from her as long as she will produce profitable litters.

It cannot be too strongly emphasised that in selecting foundation stock, the buyer should keep in mind the importance of breeding uniform pigs. The females should therefore not only belong to the same pedigree breed, but they should be in themselves as uniform as possible. Further, pedigree pigs will produce thriftier offspring than mongrels. There is everything in favour, therefore, of keeping pedigree breeding stock whether one is to produce pure breds or first crosses.

In selecting a boar one should try to get an animal conforming as nearly as possible to the standards already laid down, but in addition, he should be of a type likely to correct in his



offspring the prevailing faults of the sows. An active boar that champs and foams at the mouth when brought near another boar, and which exhibits signs of keen sexual excitement when near a sow which is in season, is likely to prove a sure stock getter. An animal which does not readily show sexual excitement may prove slow at service or may refuse to serve altogether. A savage boar is undesirable, both because he is difficult to handle and because he may breed restless and troublesome pigs. A boar should be fit for service at 8 to 10 months old.

The correct age at which gilts should be mated is a matter on which there is some difference of opinion, but on the average a gilt should be fit to serve at about ten months old. If served at eight months, which is a usual age, she is apt to remain undersized and will have difficulty in rearing sufficiently well a fair-sized first litter. If, on the other hand, she is not mated till one year old, which is the common practice in many of the pedigree herds, she may become overfat, and there is then greater difficulty in getting her to settle to the boar. In addition, at the times when she is in season before service, and more particularly after she has attained the age of ten months, she is usually very restless and excited. The body temperature is temporarily raised, and after she goes off season there appears to be a general lowering of vitality, with the result that she is then more liable to contract a chill or other illnesses.

With regard to the feeding and management of breeding stock, the main point of importance is to keep them in healthy, active, fit condition without allowing them to become too fat. Plenty of exercise, attention to the provision of a fairly easily digested ration with a sufficiently narrow albuminoid ratio,\* and an adequate and regular allowance of green food or roots, should go far to secure the desired condition. At about a fortnight before the sow is due to farrow, she should be put in the sty or hut where the litter is to be born. She requires some little time to become used to new quarters--many unsuccessful farrowings are due to putting the sow in fresh and unfamiliar surroundings too near the time of farrowing.

From the time a sow is put in her farrowing pen she should be fed on about 4 lb. per day of a special ration suitable for farrowing and suckling sows--that is to say, a slightly laxative ration with a narrow albuminoid ratio, and preferably containing 10 per cent. of bran. The percentage of barley or maize meal should not exceed 25 per cent., and an effort should be made

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\* This *Journal*, October, 1923, p. 630.

to secure for her a daily supply of fresh green stuff. The farrowing pen or hut should be about 9 ft. square, and a farrowing rail 9 in. from the ground and 9 in. from the wall is useful in preventing the sow from lying on her pigs. Short chaffed straw is recommended for bedding, as the little pigs are less liable to get entangled in it than in long straw, and are thus less likely to be smothered.

A sow that has been treated in this way should farrow without difficulty, and cases where interference or assistance is necessary on the part of the herdsman are found to be extremely rare. The herdsman should be discouraged from interfering with the sow, and it is only when it has become clear that there is some abnormal condition, that any interference is justifiable, and this should only be carried out after the most careful disinfecting of the hands and arms in a sufficiently strong antiseptic. Before the hand is inserted in the vagina or passage, it should be smeared with carbolised vaseline. The cleanse or placental membranes should be removed from the sty to prevent the sow eating them. After a prolonged or difficult farrowing the sow might be given her first meal warmed to the temperature of the body. Warm milk answers excellently.

For the first few days after the birth of the litter, care should be taken that the sow is not overfed. Overfeeding or the employment of a ration which is not sufficiently digestible will interfere with milk production, or in serious cases induce that abnormal condition of fever which results in the sow eating or destroying her pigs. After careful investigation of this matter of sows' "savaging" their pigs, the writer can say that he has found this to be very rare where proper care and attention is given to the feeding and management of the farrowing sow.

When two litters are to be obtained annually, possibly the most suitable months for the litters to be born are January to March, and July to September. In herds where contracts are made to supply regular numbers of pigs to butchers or bacon factories, it may be found necessary to have sows farrowing all through the year, but wherever possible November and December should be avoided. The most suitable age for weaning pigs is 10 weeks—this allows the little pigs a very fair chance, and if the sow is served the first time she comes in season, which will be about the fourth day after the pigs are weaned, it will enable litters to be obtained at intervals of approximately six months.

The satisfactory rearing of little pigs is the most difficult part of pig-keeping, and on it depends to a great extent the success



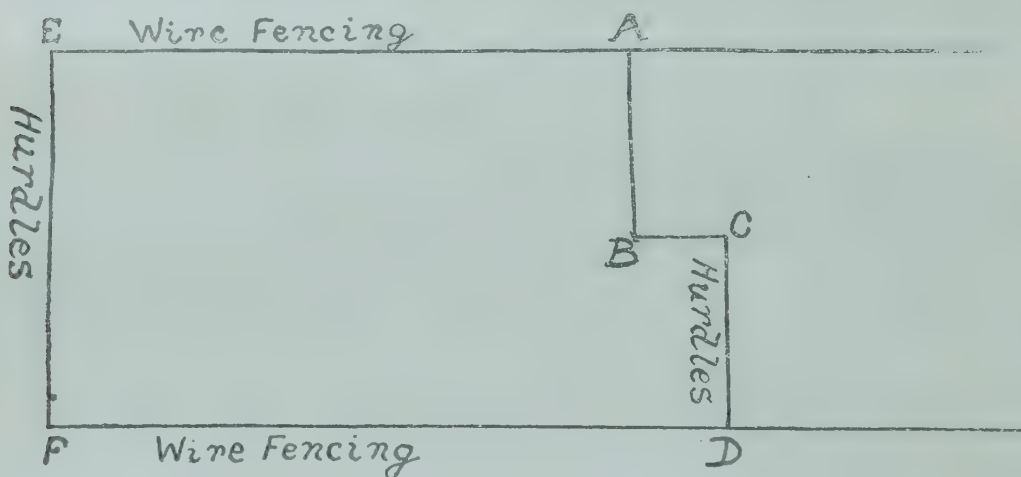
of the whole pig-keeping enterprise. The aim should be to keep the little pigs going on without check or disorder. If the sow has farrowed in an open hut with a run attached, the little pigs will soon venture out into the sun and exercise themselves. Exercise and fresh air aid digestion and sharpen the appetite, and when the sow is confined to a sty she should be allowed to go out of doors with her pigs as early as possible after farrowing, allowing for weather conditions. As soon as the little pigs will eat they should be fed apart from the sow with a ration which is specially adapted for them. With a little ingenuity, means can usually be devised for feeding the little pigs separate from the dam. In a yard or out of doors, the trough or feeder can be placed in a small enclosure made with four posts and rails so that the little pigs can get to the trough without the sow being able to steal their food. Unless the little pigs are on grass or arable crops they need green stuff or roots at the earliest age they will eat such food. When young pigs are fed in this way on dry food, and care is taken to provide them with sufficient liquid either in the form of water or separated milk, they seem to do better on dry than on wet feeding.

**Open Air Pig-Keeping.**—The fundamental principle of open air pig-keeping is that pigs are not confined to sties all the year round but are allowed out to graze either on grass, or arable land or in woodlands. Usually a hut or cheap shelter is provided. Open air pig-keeping was not common before 1914, but it had been practised in a few herds for some years previous to that date. The possibility of its successful application to commercial pig-keeping has now been generally recognised, and it has become the established practice in most commercial pig breeding enterprises.

When carried on in woodlands as is frequently recommended, there must be very considerable loss of valuable manure unless the woodland is made use of afterwards for some special purpose for which the residual value of the manure can be fully utilised. The possibilities of such use are not very great, and it would seem desirable that on a mixed farm pigs should as far as possible be kept on arable land. In the case of very poor grassland, however, pig grazing in conjunction with the judicious application of artificial manures, notably basic slag and lime, has brought about marked improvement.

There is an absence of exact information on the economic side of arable land pig-keeping. On the technical side it has been demonstrated that a suitable succession of crops can

be grown, and the pigs managed successfully while folded on them. Arable land pig-keeping has been carried on with success by Messrs. Wilkin & Sons, at Tiptree for some years,\* and it is now being practised to a considerable extent throughout the country. Generally speaking, the same crops and conditions which are found suitable for the folding of sheep will be suitable for the folding of pigs. Pigs show a preference, however, for vetch mixtures, clover, lucerne and rape. They do not appear to care for turnips as grown in the Midland counties, but they like swedes. Helpful suggestions as to suitable successions of crops have been made from time to time by Stanley Wilkin in his publications,† and also by J. C. Brown in Harper Adams College Reports. A farmer should have no great difficulty in working out a succession to suit the circumstances of his particular farm, but where the results of local experience and experiments are wanted for guidance he should apply to the Agricultural Organiser for his county for information.



Mr. Wilkin states that a sow will eat 16 lb. of kale per day, a six months old pig 10 lb., and a four months old pig 8 lb. Our investigations with regard to green and root crops generally, would tend to show that, making an allowance for trampling, rather higher quantities will be accounted for, say, 20 lb. in the case of the sow and 12 to 14 lb. in that of the six months old pig. The table given on p. 711 of this *Journal*, November, 1923, will show the rate at which these quantities of forage crops will replace mixed meal in feeding. Taking the above figures and the average or estimated yields of different crops, a simple calculation will show the acreage required for a given number of pigs. If we take an average crop of thousand-headed

\* See this *Journal*, August, 1920, pp. 456, 457.

† Stanley Wilkin's Annual, 1923-4, 1/- post free.



kale as 16 tons per acre, 14 sows each consuming and trampling 20 lb. per day would use  $2\frac{1}{2}$  cwt. daily, or 1 ton in 8 days. One-quarter of an acre of kale would therefore supply green food for the above number of sows for 32 days. In-pig sows eating this quantity of green stuff would need in addition about 2 to 3 lb. of mixed meal per head per day according to their condition.

The fencing of pigs on arable land may present some difficulty. Iron hurdles on wheels are satisfactory but they are expensive, and it is suggested that the fold be laid out with two parallel rows of pig wire fencing, and wooden or wattle hurdles used crosswise (see diagram on p. 796). To give a fresh supply, the hurdles A, B, are moved forward to give a straight line with C, D. Next day the hurdles C, D, are moved forward and the hurdles C, B, again inserted, and so on.

Shelters on runners which can be moved by yoking a horse to them are found most convenient for folding where frequent changes are necessary. To secure the uniform distribution of manure, it is essential that the huts and feeding troughs should be moved at frequent and regular intervals, preferably daily.

We do not favour the keeping of pigs in small enclosures with permanent grass runs. These grass runs are apt to become very foul and muddy in winter or during a prolonged period of wet weather, especially near the huts and feeding troughs. It has been found that foul runs may become infested with worms which are parasitic in the pig. Further, in summer it may be difficult to keep the grass closely enough grazed. It is better wherever practicable to give pigs a considerable range on grass-land and if due consideration is to be given to the improvement of the herbage, grazing with other classes of stock will be advisable at intervals. It is most important that the grass should be cropped down bare at least once a year. Grazing with stock other than pigs, or mowing, may be employed to secure this end.

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## THE TEACHING OF AGRICULTURE.

SIR A. DANIEL HALL, K.C.B., LL.D., F.R.S.,  
*Chief Scientific Adviser and Director-General of the Intelligence  
Department of the Ministry of Agriculture.*

*The substance of an address given by Sir Daniel Hall to  
the Agricultural Education Association at Aberystwyth on  
10th July, 1923.*

I CANNOT help feeling that the object of my remarks is still somewhat in a tentative condition, and it may be better if I reserve a formal exposition of the subject so that all I have to say may be regarded by way of stimulus and suggestion rather than a direction to a particular action that I should like to see taken. This must be the case with all good teaching. The teacher has to work out a method, that method may not be a good one for universal adoption, but if a man has worked it out for himself and is keen, the very fact of his keenness may make that method an extremely profitable one.

**Closer Consideration of the Method of Teaching.**—What I have to bring before you is this, put broadly, that the actual method of our teaching, whether we teach inside the college or the farm institute or whether we teach in the county, requires more consideration than it ordinarily gets. We all of us in this country begin teaching agriculture in a thoroughly haphazard amateurish fashion. We go to college and later on when we leave, we find ourselves put in front of a class and required to teach on our own account. I think most people's experience would be similar to mine; no one gave me a hint or suggestion of what methods to follow—I floundered about and tried one method after another.

Many scientific and technical men have a certain scorn for what generally may be called the art of exposition, whether in speech or writing. In writing I have often occasion to deplore the style and quality of the written matter that is put out. In teaching I have from time to time listened to lectures and classroom instruction, and I do think the teaching might be enormously improved if the men thought a little more about this matter of teaching as an art in itself, independent of the material that is to be set forth, an art which has a code of rules and laws of its own. I do not want to lay down methods at this moment. Every man will think out his own method, but I do want to plead for a consideration of the method itself



as something worth thinking about, something by which the work—whether it is in classroom or lecture room—can be made more effective. I want you to take it that teaching is not a process into which you drop quite naturally, that it only involves the doling out of so much information to be got up by the class, whereby all the teacher can be expected to do will have been accomplished. If that were the case, if there were nothing in the functions of the teacher but to hand out a certain amount of knowledge, why have any oral teaching at all? Why not content oneself with books, or with some kind of organisation like the correspondence college? The organisation of a correspondence college for example can show the student exactly what he ought to read, it can set him papers, mark and comment on them. The way these colleges flourish proves that they can be effective in promoting the acquisition of knowledge for examination purposes. In fact one must take it that the very existence of these correspondence colleges on a large scale points out that there is a defect in the ordinary teaching given in the country. If the oral teaching were of the right kind the correspondence college, which gets its results and could not live if it did not get its results, would go out of existence.

To give an illustration of what I mean; you are all familiar with one of the very commonest forms of classroom teaching in University or University College—the lecturer who practically dictates to his students a certain text which he has prepared. The lecturer prepares very carefully his lecture as a résumé of a particular section of the subject and delivers this from the platform so that every student may take it down verbatim and get it accurately transcribed into a notebook. That form of instruction is very popular, especially amongst students. It supplies them with a short cut to knowledge; it absolves them from the necessity of reading anything other than their notes. They need not buy text-books; still less need they compare the different views of other people on the subject, and they regard this as a very profitable form of instruction. If they get up the notes which the professor has given them they expect to be able to pass the required examination. One knows the type of lecture notebook which is produced in that way, and I believe in some of the Universities it has considerable financial value. That always reminds me of a story of a Cambridge undergraduate in the time of a very famous coach known as Big Smith. The undergraduate had just come into residence and was taking counsel with some senior friends

as to what course to pursue, should he read for Honours or a Pass. He asked what was the difference between a Tripos and a Poll degree. The old hand replied "if you go for the Tripos you go to Brown, of Trinity, and he tells you what he thinks about it; then you go to Jones, of Jesus, and he tells you what he thinks about it; then you go to Tomkinson, of Caius, and he tells you what some other Johnny thinks. If you take a Poll you go to Big Smith and he tells you what it *is*." That is the attitude of the typical undergraduate; he wants positive knowledge delivered to him in neat little packets ready to be handed over the examination counter. I submit, however, that the teaching of that kind will eventually be replaced by the gramophone. It would be cheaper to the University to replace such professors by gramophones.

Of course there is the converse of the process, where the lecturer refuses to allow his students to take a note at all. That was my own practice in the later days of my actual teaching career. I was asking my students for their attention; I did not want them to divert their attention by taking notes. The object of my lecture was to impart a point of view and to get my students to apprehend the principles of the subject. So far as notes went it was my practice to issue a typescript at the end of the lecture, which contained subject headings, tables and diagrams, and references to the text-books indicating where details of the matters dealt with could be found. I do not say mine was the right way but it was an attempt to teach, whereas the other way is only an attempt to supply information. I throw out that as an illustration; the point I want to make is that the mere process of teaching does require thinking about.

On the other side let us take the outside lecture, the lecture that every college or institute teacher is required to give from time to time to audiences in villages and country centres. As a rule the preliminaries are organised for him; he walks into the place and is rather apt to suppose that if he delivers the lecture and the people do not leave the room in too large quantities during the process, that his method is good. If the audience falls off during the lecture course, he blames the organisation.

But we have to ask ourselves whether the lecture method is suited to the village audiences at all, whether the type of teaching we have to do in the counties has not got to start from an entirely different point of view. I want to suggest that



the prime effort of the extra-mural teacher must be in some way to drag the members of the audience into the fray themselves. They must be led to become active participators in the process of education. You have not much time in dealing with an audience of that description; you are running over the whole of agriculture, perhaps in six lectures and you only have time for stimulus. The technique of the process by which you can get your pupils to read and work for themselves does require a good deal of consideration. Put yourself the question, "How am I to get my audiences to help themselves? I, in charge, can only help people, I cannot teach them; I can only point out the lines upon which they can teach themselves."

**How we can Improve our Methods of Teaching.**—I take these as illustrations of the kind of subject I should like to see discussed, the methods of teaching inside and outside the college, how, by thinking for ourselves, we can improve our own methods. I want specifically to suggest the question of how the subject of agriculture itself ought to be treated in our Colleges and Farm Institutes, etc., because there I can see perhaps the greatest opening for better technique and indeed for some considerable reconstruction of our aims in teaching agriculture.

I think we are inheritors in this country of rather a mistaken tradition. I know quite well 30 years ago when colleges began to start in Great Britain for the teaching of agriculture, the general idea of their founders was that agriculture could be regarded as an assembly of applied sciences. There was chemistry, botany, zoology, geology and so forth, all sciences throwing light upon the growing of crops and the feeding of animals. If we first taught these sciences to agricultural students and then the application of those sciences to agriculture, we were teaching agriculture. You may remember that the first Cambridge diploma did not proceed further than that. It was content with an examination in applied sciences and treated agriculture itself as one of those rather mechanical extras which are pursued in practical life but which should hardly concern the university. So I think we were given a set towards the treatment of agriculture as just an assembly of applied sciences, and it was conceived that we could bring out a farmer by grounding the youth thoroughly in chemistry, botany, zoology and so forth.

Now agriculture is a subject *sui generis*, something quite distinct from an applied science; it has its own technique and

methods and its own fundamental science, which is neither chemistry, botany nor zoology, nor anything of the kind popularly termed science. It is accountancy which lies at the basis of the teaching of agriculture, and as pure chemistry is the grammar of the agricultural chemist and botany of the agricultural botanist so is accountancy the grammar fundamental in the instruction of the farmer.

**The Object of our Teaching.**—If we start off with that somewhat one-sided statement we shall get a little nearer to what is the right form of teaching. Let us begin by asking ourselves what we are after when we are dealing with the young men in an agricultural college. What is our object; what are we going to try and turn out? I think it is agreed that we are not thinking of turning out teachers, officials or that kind of man; we are thinking really of turning out a thoroughly equipped farmer and we want to ask ourselves what we mean by that—a thoroughly equipped farmer under modern conditions, and how we can help to ensure that type of man by education. We know well the old farmer who has no education behind him; he tells the teacher that no-one can learn farming in a classroom and that he has no opinion whatever of book farmers. The answer is not easy, but I think we can remove that kind of reproach if we take our teaching of agriculture from a somewhat different angle. What he means is that success in farming depends upon a number of qualities which are personal and many of which are only obtained by experience. If a man has no will or determination, if he lacks a certain firmness about making a bargain, of course he cannot become a successful farmer—and none of the efforts of the educator are directed towards giving these qualities.

Still, putting aside these inborn faculties and the essential matter of experience, what does characterise a good farmer as distinct from a bad farmer? We can sum it up in one word—management. The good farmer not only knows what work has to be done, what good work is, the technique of growing his crops and breeding cattle, etc., but he knows how most effectively to dispose of the staff of labour that he has on that particular land. His job as farmer is a manager. The agricultural college is dealing mainly with men who are going to be managers of labour, directors of other people's work. They are not going to do manual work themselves, except perhaps in their younger days, but in the main they are going to be heads and not hands.



**Developing the Idea of Management.**—When you turn to compare the successful with the unsuccessful farmer you will probably find in a great many cases that the question of financial success depends upon this disposal of labour more than anything else. We may sum up the object of the agricultural college as the training of managers. That being the case what I want to submit to you is that we must direct our teaching to that end.

Suppose we turn to one of the most successful text-books on agriculture that we have in England, the late Professor Fream's—almost the only widely distributed text-book that has been written in English on agriculture—do you find that point of view, management, set out from the beginning of the book to the end? There may be an odd chapter or two about it, but in the main the book is concerned with the description of the materials of the farmer. You are told how to discriminate between fescues and poas, hop trefoil and yellow clover—just the kind of things that are so much taught and learned by the agricultural student and so heartily despised by the old type of farmer. The old farmer is wrong; you cannot know too much of anything. None of these descriptive points are without their value, only they cannot replace the other things, the vital study of the economics of a farm and its management. That is the point that I want to bring forward in these remarks.

The teaching of agriculture as I have seen it, and I speak from experience, is far too much a mere matter of description. It may not even be descriptive of the kind of farm the teacher knows himself, it may be a discussion on the old systems of farming. It is not unknown that men continue to teach the East of Scotland form of agriculture as described in Stephens' "Book of the Farm" as the only method of successful farming. It may have had little to do with the farming that was going on round about the college, having been worked out on a different rotation and for a different soil and climate. Let us have done with this purely descriptive teaching of agriculture.

The teaching of agriculture should be to an increasing degree a matter of personal experience, and it should be in every district largely based upon what is going on round about the college. It should begin as a description, so far as it is descriptive, of the farming practice amongst the people the student comes from; that is the first thing; let us localise our teaching. In this way the teacher can introduce the element of personal

investigation; he begins by finding out what the people round about are doing, that will lead him to comparisons of their methods with other people's methods. He can fall back on the standard system of his text-book, compare it with the local system and discuss the difference that he finds between the two. The critical faculty is brought into play.

But we must go a step further if we have in view management, so that the student, when he leaves college and begins to work on his own account, shall be in a position to be critical of the work that he gets done, and not merely in the hands of his foreman or bailiff. We must not be content merely with describing. We must ask ourselves about each of the processes, how many men, how many horses, how much time, what will it cost step by step, and criticise these costs in the light of the results. Here the real critical process comes into play. The agricultural teacher dealing with, say, the potato crop, should have acquired for himself, by direct observation, a picture of the practice of a successful potato grower under certain conditions. He has followed the crop through, he has found out the number of men at work and the amount they did, and he is in a position to sum up the costs. That alone is a description which may be a great help to a student later on. But if he can set alongside that a description of the methods of two other equally good farmers and in different districts with the details of the alternative operations, the number of men on the job and the costs, I should think he is entering his students in the art of being managers. That is the first step. It has not got to end there.

After the teacher has been through the raising of crops and the treatment of livestock as individual operations, he has got to get his students into a perception of how a really good farmer schemes out his work from week to week, and how, given a certain staff at his disposal, he uses them to the best advantage. From my own observation of practical farming there lies the difference between the successful and the bad farmer—the way in which a good farmer has his work planned out and with a given staff always is ready to throw in his strength at the right moment. Of course you cannot teach that, but you can awaken the student very much to the necessity of thinking it out for himself.

It is in that connection the college farm is going to be most useful for the purpose of the teacher. The college farm should be run as a practical business proposition which is illustrating management and which is a text-book of the teacher in the



lessons he is giving. Every student should keep an exact diary week by week of the operations that go on on the college farm, and it should be a diary with full details. It does not record "March 15th, sowing barley on the 10-acre field." No, he says "sowing barley on the 10-acre field; wheat stubble ploughed in November, wanted more frosts, a little stale on top and wet below." Then should follow the operations, the horses and men to each and the time taken. Further, the teacher should be giving the actual cash transactions from week to week. The teacher taking his class on Monday morning will say "our business during this week is so and so, I propose the men shall do so and so," and he shows them how he has schemed out the use of his staff during the week and the alternative in case the weather is unfavourable. It is in this way we can make our agriculture itself scientific, and not merely descriptive of accessory scientific facts which may be of value but which are of secondary importance compared with the question of management.

When we get on to the second and third year of teaching we have to consider broader economic questions; the reason for this or that branch of the business, why we are producing milk, why we are fattening bullocks, etc. We can begin with a consideration of the policy of the college farm, for it is the one which is close at hand, the one about which the teacher has the most details. But neighbouring farmers are generally willing to help the college by disclosing enough of their accounts to give the teacher materials for the discussion of policy. Now this means that agricultural teaching should be founded upon a system of cost accounting. The future of efficient management depends fundamentally upon a good book-keeping system to begin with, and the constant use of that book-keeping to check operating costs, so I think that the student must be inducted early into the point of view of cost accounting.

We are apt sometimes to assume that we can describe the right method of farming. I do not think there is a right method of farming, there is only a best compromise to adopt under given circumstances as regards soil, climate, markets, etc. The teacher's object should be to get the student into a critical way of examining other people's work so that eventually he will pass on to criticise his own work. The machinery for this is only to be supplied by a sound system of costing. Therefore the teacher of agriculture should investigate costs for himself so as to establish a comparative system of teaching, comparing

A's methods with B's methods and discussing with his class how relatively they arrive at the same ends though one may cost a little more. He is then in a position to criticise the whole conduct of particular farms, always with the management in view, and the results in cash as the fundamental test of the rightness or otherwise of the operation.

I do not think I need say anything more. I could have elaborated, but I rather want to throw out these suggestions for you to turn over for yourselves and see if they will not strike on your box and modify the methods by which you teach. I am convinced that if you think about these points of the technique of teaching, you can make your work more effective.

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## THE AGRICULTURAL SITUATION IN THE UNITED STATES.

THE rapid fall in prices, particularly of agricultural products, that has taken place since the War, has been experienced with at least as great severity in the United States as in Europe. So seriously have the depreciated values of its produce, as compared with the costs of growing it, affected the farming industry, that the United States Government last spring called a conference of economists and others to examine the situation. Four Committees were appointed to deal more especially with the prospects of foreign demand for American farm products, the prospects of the home demand, the position of the hog industry, and wheat growing. These Committees submitted reports, and a second conference in July last approved these reports and drew up a general summary of the situation. The following notes represent the conclusions of the conference: the data given in the reports have been reproduced, but more recent estimates issued by various Governments are given in brackets, so as to bring the information down to the latest date.--

**Wheat Situation of the World.**—A current crop for the Northern Hemisphere moderately larger than that in 1922 is indicated. The Committee report that this increase represents only a small percentage, adding the caution that it might be entirely wiped out, or on the other hand augmented, by later developments in North American spring wheat or in the crops to be harvested early in the New Year in Australia and Argentina. (This caution was justified, for later reports



regarding the crop in Canada point to a harvest considerably greater than was then anticipated.)

In the United States this year's production of wheat was in July forecast at 440 million cwt. (the October estimate puts it at 419 million), as compared with 462 in 1922, and a pre-war average of 370 during 1909-13. The Canadian crop was regarded as probably being in the neighbourhood of that of last year (latest indications make it 37 million cwt. greater), when it was 214 million cwt., the pre-war average being 106 million.

In Europe, judging by those countries for which data were available, it was expected that there would be an increased production of 63 million cwt.; while North Africa would yield 13 million more; in India and Japan there was an increase of 18 million. (The latest data point to an increase over last year in Europe, excluding Russia, of 131 million cwt.; North Africa also has better prospects, while little change has to be recorded in India.) Taking all these figures together, the increase in the Northern Hemisphere was in July estimated at about 72 million cwt. (latest returns indicate 150 million cwt.). In the Southern Hemisphere, where seeding was going on at the time of the report, an acreage about equal to last season's was expected to prove a reasonable estimate (the latest Argentine official estimate is for an increase of over a million acres in that country).

While European production is higher than in 1922, the latter year was over 100 million cwt. below 1921; nevertheless, Europe only imported about 27 million more in 1922-23 than in 1921-22. The difference between crop deficit in 1922 and increased imports was apparently made up by (1) greater rye and potato consumption, (2) closer milling extraction, and (3) a probable reduction of European wheat stocks.

As regards Russia, the Conference consider that, while reports are conflicting, it is probable that the areas of wheat and rye this year are about one-half the pre-war totals, whereas the population is two-thirds of the pre-war population. With normal pre-war consumption this would admit of little or no export. Lack of farm animals, machinery and fertilisers, together with poor transportation, are factors indicating that Russia will not export large quantities of grain in the immediate future.

Owing to the world war there was a very great increase in the wheat acreage of the world, outside Russia and the Danu-

bian countries. Before the War, Russia, Rumania and Bulgaria exported more than 100 million cwt. of wheat every year, or about 30 per cent. of all the wheat exported by exporting countries. Owing to the isolation of these sources of supply during the War, the acreage in four of the five other principal exporting countries increased; since the War it has decreased again very slightly. The changes are shown in the following table (thousands of acres) :—

				<i>Pre-War,</i> <i>1909-13.</i>		<i>War Peak,</i> <i>1918-19.</i>		<i>1923.</i>
United States	...	...	...	47,097	...	67,437	...	58,253
Canada	...	...	...	9,945	...	18,240	...	22,165
Argentina	...	...	...	15,799	...	17,425	...	16,081
Australia	...	...	...	6,798	...	8,882	...	9,804
India	...	...	...	29,043	...	29,642	...	30,492
TOTAL (5 countries)				108,682	...	141,626	...	136,795

These five countries are growing 28 million more acres of wheat than before the War; and this considerably more than replaces the pre-war surplus from Russia and the Danube.

The five principal importing countries of Europe (United Kingdom, Italy, Germany, France and the Netherlands) whose average pre-war area was 34½ million acres under wheat, are now growing about 31 million acres, having recovered to that extent from the low point of 26 million acres reached during the War.

It is concluded that the expansion in the wheat area of the chief exporting countries, coupled with the decreased buying power of Western Europe, is responsible for the price situation which now prevails. It is also stated that significant changes have taken place in European methods of purchasing wheat. Before the War, wheat was bought in large quantities shortly after harvest for either immediate or forward shipment. Owing to the straitened financial conditions of European consumers, and difficulties incident to a fluctuating exchange, there has developed a tendency to purchase more largely from hand to mouth. This increases dependence upon American storage and financial facilities, and suggests the necessity of producers, bankers and handlers considering the advisability of more gradual movement from the farms to meet the new methods of foreign purchase.

The Conference conclude with the suggestion that the American wheat grower should take the first positive step this autumn to adjust his winter-wheat acreage in accordance with the world situation. This amounts to a recommendation



to American farmers to reduce their wheat acreage. Since this Report was issued, an inquiry conducted by the Department of Agriculture among 25,000 farmers has elicited replies to the effect that they intend to reduce their winter-wheat area by  $15\frac{1}{2}$  per cent. If this were done by all farmers, it would imply a total area under winter wheat in the United States of some 39 million acres, whereas in the autumn of 1922 the acreage sown was over 46 million acres, of which 39,750,000 proved to be ultimately harvested, the balance (a higher proportion than normal, however) having been abandoned owing to "winter-kill." If the farmers carry out their intentions, and if only the average area is winter-killed, it would imply an area of rather over 35 million acres actually bearing a crop.

**Maize and Hog Situation.**—A special pig survey was taken on 1st June, from which it appears that there was more breeding this last spring than in 1922; also inquiries addressed to 140,000 farmers elicited the expressed intention to breed 28 per cent. more sows this autumn than in 1922. Probably the amount of breeding will be less than the expressed intention: last year the increase was only about half that stated in a similar inquiry. These investigations have revealed that hog producers in the United States are inclining toward autumn-breeding, making for a more even distribution of marketing throughout the year. The spring farrowings showed also that while the increase is due to increases in the Corn Belt (*i.e.*, the area in which the bulk of the maize is grown) and the western States, many of the important cotton States this year showed a decline, cotton apparently replacing some of the maize and peanuts there. As the indications given by the similar survey last year proved on the whole well founded, it would seem that, on the basis of this year's survey, provided that the mortality is no greater now than last year, the commercial market supply of hogs (over four-fifths of which comes from the Corn Belt) from the spring crop of 1923, should be about as large as that from the spring crop of 1922. If expressed intentions as to breeding are carried out, to the extent of half, as last year, the autumn crop of this year, which will be marketed next summer, will be larger than that of last. However, recent developments may cause farmers to market during July and August a considerable number of sows that they had intended to use for breeding this autumn.

During the last year or so, more hogs have been marketed than in any other like period in history. eight months' records

showing an increase of 30 per cent. over the previous year, and 60 per cent. over a corresponding pre-war period. This greatly increased production has been due to the large maize harvests.

The maize crops of the last three years have been unusually heavy, and the price has been very low. To utilise the large surplus of cheap corn, hog production has been greatly expanded. This increase in hog production has now cleaned up the unusual surplus, with the result that the stocks of 1922 maize on farms were in July at about the pre-war average, and prices have recovered from their extremely low point. July prospects were for a normal 1923 corn crop (according to latest official statistics these prospects are somewhat improved). Thus the corn situation does not warrant the maintenance of the very heavy hog production of the past year; and if it is maintained, a maize shortage may develop by the summer of 1924.

The history of the past fifty years indicates that there is a rough general tendency towards over—and under—production of hogs in cycles of about 4 years from maximum to maximum. From the autumn of 1920 until that of 1922, hog prices were high relatively to maize. This high “corn-hog ratio” stimulated heavy breeding, with the results that hog prices fell until now (July) they are 25 per cent. below the 50-year average ratio. In spite of this sharp decline heavy breeding has continued, with the prospects that the unfavourable “corn-hog ratio” of the past months will last into 1924.

Considering the demand for pork and other pig-products, the Conference notes that the quantity in cold storage at the moment was not particularly excessive, and thus they conclude that there is no slackness in the demand. In the case of lard, stocks were below average, and thus the outlook for this was quite favourable. The population has already this year consumed 5 lb. of pig-products per head more than in 1922, and if this is maintained it would imply an annual consumption of 85 lb. per head, an amount only once exceeded 15 years ago. This heavy consumption may be expected without further serious decline in prices, since the active employment of labour has supported the pork market far beyond what might have been expected from a consideration of the heavy hog production. The ability to do so in future depends upon the maintenance of favourable industrial conditions.

The foreign demand for pig-meat has been unexpectedly large. The export trade takes approximately 10 per cent. of



the total United States pig-products, and Europe has this year taken a decidedly larger proportion at a higher price than seemed probable. England and Germany still remain their principal customers, with considerable quantities also going to Belgium and the Netherlands. Britain's imports of lard have decreased, but the Continent has been taking more.

While the foregoing considerations indicate that the last of the 1922 pig-crop will be readily absorbed by the present market, the selling of this year's pig crop at a price on a level with the crop of 1922 is more problematical, and will depend on the continuance of active employment of labour in the United States and a favourable condition of the European market. The maintenance of the very heavy rate of pig production of the past year does not seem warranted by the maize situation.

In considering the domestic demand for farm products generally, apart from the two special factors just dealt with, it is pointed out that two facts stand out very clearly. The first is that there has been in the United States a very high level of industrial activity, distribution and consumption. Within the last twelve months the general level of prices has been fairly steady, the changes actually noted not being regarded as materially significant. The second fact is that throughout this period of great prosperity, the prices of most farm products, with the exception of cotton, and latterly of corn, have been abnormally low. The farmer, in marketing his produce, has had, much more than the manufacturer, to meet world conditions; and as a result agriculture has not generally shared in the marked recovery in 1922-3 in the United States. Owing to the general prosperity, the home demand for farm products has been near to if not at a maximum; the people can scarcely consume more of wheat and meat and other produce than they have done in the last year or more. The farmer therefore cannot now expect any immediate increase in the domestic demand. On the other hand the present full volume of employment and high wages are maintaining the consumption; and the probability of any severe depression in the near future seems to be slight; while lessening of industrial activity would probably affect only the demand for the choicer products, perhaps even thus increasing the demand for the cheaper grades of food. It is concluded, therefore, that, so far as domestic requirements are concerned, there is no special reason to expect a sharp decline in the average prices of farm products.

As regards foreign demand, European countries constitute the only significant markets for American agricultural products; and the position in the future depends mainly upon three factors: (i) the essential food requirements, depending partly upon crop conditions in Europe, (ii) the competition of other food-producing areas, and (iii) the purchasing power of Europe.

The European nations are gradually approaching their pre-war level, especially continental importing nations. Data showing this in the case of wheat have already been quoted. Crop conditions in Europe generally are much more favourable this year. Revival of production in Europe is much more manifest in agriculture than in manufacture.

In estimating the probable demand for American foodstuffs, adverse economic conditions may seriously reduce the consumption even of essential foodstuffs. Figures are given indicating that Germany's consumption of wheat in 1922 was only 55 per cent. that of 1913 and rye but 60 per cent. Barley and oats were but a third or a half, while potato consumption amounted to 93 per cent. There appears here a shifting from bread to potatoes. The extent of this shift is greater than the figures indicate, for it is stated that less potatoes are fed to pigs and more are reserved for human consumption. It is also stated that a similar shift is being made in many other countries of Europe.

Europe's purchasing power will depend upon the volume of her exports, the amount of her earnings on investments abroad, on shipping and other services, and on credits. The United States send more goods to Europe than they receive from her, though the balance has of late diminished moderately. There appears to be a shortage in the European production of manufactured goods—such as America requires—and moreover there is an increasing reluctance, as manifested in the tariff laws, to receive European goods. These factors, coupled with the Ruhr situation, and the necessity of the British Government to make large remittances on account of the nation's war debt to America, are all regarded as factors inimical to European buying power; and the conclusion is drawn that, unless the Ruhr situation is speedily cleared up, and a definite turn for the better takes place in Europe, there will probably be less foreign demand for American farm products this season.

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## CO-OPERATIVE CHEESE-MAKING CENTRES IN SUSSEX.

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CHEESE-MAKING in Sussex on modern lines is of quite recent origin; in fact the production of milk itself on a large scale, now the most extensive branch of the agricultural industry of the county, is also a development which has come about practically within the last half century. Hence, the introduction of the first large dairy herds, kept primarily for milk production, is well within the memory of many still farming in the county. Until late years the demand in East Sussex for fresh milk has kept pace with the increased supplies available. The requirements of London and the south coast towns made it unnecessary to convert any appreciable amount of milk into either cheese or butter. It is true that on many of the smaller Wealden farms butter was made, and is still made to a limited extent, but the large producers of milk depended entirely on the sale of liquid milk.

For some few years before the war, however, the supply at certain seasons exceeded the demand, and this situation has now become intensified and is likely to become still more acute.

Factories and retailers have hitherto generally taken the total output of the farmer at a fixed price, and under such conditions the price paid to the farmer was a price which enabled the retailer to recover any loss sustained in dealing with surplus milk which he could not profitably utilise. At the present time, however, most of the contracts entered into between producer and buyer are such that surplus milk is paid for at a rate which depends on the price of imported cheese. In Sussex the situation had therefore become more difficult than in many counties which have long been associated with the manufacture of cheese. In the western counties it has for years been the practice of milk producers to sell milk when satisfied with the price that could be thus obtained, sometimes throughout the year, but frequently only during the winter months. Such producers were thus always in a position to make the best possible terms with their buyers owing to an alternative outlet.

### **Demonstrations by the Agricultural Education Committee.**

—The unusual position of a county where supplies were tending to exceed the demand, and where alternative outlets did not

appear to exist, was a factor which induced the East Sussex Agricultural Education Committee to adopt the Ministry's scheme for co-operative cheese centres. It is not an easy matter, however, to introduce innovations with rapidity into established agricultural conditions, so that before co-operative cheese-making centres could be successfully established, a considerable amount of preparatory work had to be carried out.

In 1918 cheese-making was started on a very small scale. Peripatetic work was undertaken dealing with quite small quantities of milk, the capacity of the vat used being only approximately 40 gallons. This peripatetic work, however, was sufficient to create an interest and also a favourable atmosphere.

The next step was to demonstrate at the County Farm, Plumpton, that it was a fallacy to imagine that first-class Cheddar cheese could only be made in such fertile districts as those existing in the west of England.

At the county farm, as on the majority of Sussex farms, no suitable place existed for making Cheddar cheese. A home-constructed dairy was, however, equipped out of part of a cart-shed. All work in equipping this dairy was done by the ordinary labour on the farm, except the installation of a boiler and steam fittings, etc.

In addition to making into Cheddar cheese the milk produced on the farm, milk was purchased from adjoining farms, and during the months when the adjoining creamery could not readily deal with this surplus milk, Cheddar cheese was made. At the termination of the cheese-making season, the milk was sold at very favourable terms as accommodation milk.

In order to create further interest in the work, a large quantity of the cheese was sold by auction in Lewes market.

Despite the disadvantage of the roughly-equipped dairy, Cheddar cheese of very high quality was made, and the demand far exceeded the supply.

In 1920 some of the cheese made was exhibited at the Sussex County Agricultural Show at Chichester. In 1921 a considerable amount was again exhibited at the same Show at Hove, whilst at Hastings in 1922, the Sussex Agricultural Society awarded a special diploma for an "excellent exhibit of cheese." In 1923 at the Sussex Show there were 15 exhibits of Cheddar cheese, the first prize being awarded to that made at the county farm, and the second to the Hurstpierpoint centre. At each of these agricultural shows efforts were made to popularise the idea of utilising surplus milk for Cheddar-cheese making.





FIG. 1. —Lewes Co-operative Cheese-making Centre.



FIG. 2. Press Room at the County Farm, Plumpton.



FIG. 3. Cheese-making Dairy at Hunsfords Point.



**Hassocks Co-operative Cheese Centre, Hurstpierpoint.**—In 1921 the Hassocks Branch of the National Farmers' Union, which embraces within its area the county farm, decided to establish a co-operative cheese centre at Hurstpierpoint. An old brewery was obtained which was equipped partly with the apparatus provided by the Ministry under its scheme, and partly by the guarantors of the centre. In order to provide working capital, the supporters guaranteed an overdraft at the bank. During the contracting period, at the end of March and the beginning of April, when some difficulty was being experienced in the district in disposing of milk, the centre was working up to its maximum capacity, but as soon as contracts were fixed, the centre temporarily closed until there was again a surplus of milk in May and June. The centre then re-opened and dealt with all the surplus milk available.

The work at this centre was supervised by the county instructress, whilst the local branch of the National Farmers' Union provided assistants who were trained with the object of conducting the centre when county assistance should be withdrawn.

Owing to the initial capital cost of equipping the centre with boiler, steam pipes, cheese racks, etc., the members could only pay out at the rate of 7d. per gallon for milk supplied during the first season.

**Lewes Co-operative Cheese Factory.**—The activities of the Hassocks Branch of the National Farmers' Union caused the adjoining district at Lewes in 1923 to equip a centre similar to that which had been so successfully run at Hurstpierpoint. In Lewes considerable difficulty was experienced in finding suitable buildings, but eventually room was found in another dis-used brewery. Such buildings may have been ideal for the production of beer, but very considerable difficulty was experienced, but eventually overcome, in adapting them for cheese-making.

The cost of equipment at the Lewes centre was appreciably lower than at Hurstpierpoint owing to the fact that steam could be obtained from a boiler originally used in connection with the brewery. In order to minimise expenditure in every possible way, the centre was equipped as simply as possible, partly by the supporters of the scheme, but chiefly by the apparatus provided by the Ministry, so that in May, 1923, the centre was able to deal with all the surplus milk of the guarantors which, at the maximum period, amounted to 240 gallons per day.

At the Lewes centre, 9,124 gallons of surplus milk were dealt with, and to their intense gratification the guarantors found that in closing their first season's venture, they were able to pay out to the guarantors 1s. a gallon for all surplus milk sent to the centre. This remarkably satisfactory state of affairs was to some extent due to the fact that owing to the difficulty of buying Colonial cheese in June, there was a keen demand for English-made Cheddar. A considerable quantity of the cheese was sold unripened at 1s. a lb., and as in its green state nearly  $1\frac{1}{4}$  lb. of cheese was made from a gallon of milk, and as the whey was sold at 1d. a gallon, the return from a gallon of milk was extremely good. Later in the season the price of English Cheddar rose considerably, and higher prices could be obtained locally than were being paid for similar grade cheese in the cheese-making districts, especially as the cheese sold in almost every case went direct from the cheese-making centre into the retailers' shops.

**Revised Rules for Lewes Centre.**—In establishing the Lewes and Hassocks centres, rules based on those recommended by the Ministry were laid down and generally were found to work quite satisfactorily, but the guarantors of the Lewes cheese-making centre have now decided to put their centre on a somewhat different basis, as the farmers supporting this centre feel that all the cost should not fall on those sending milk to the centre, especially when, as in a county like Sussex, the cheese-making period can generally only extend over a short period. The guarantors of the Lewes centre, therefore, have decided to extend their activities, and instead of defraying all expenditure in connection with such centres out of the milk actually sent, to pay general establishment charges by subscriptions from members.

The following particulars and rules were circulated by the supporters of the Lewes scheme at the termination of the first season's enterprise.

“The guarantors of the Lewes Co-operative Cheese Factory invite dairy farmers in the Lewes district to join with them in continuing and expanding the centre. They especially desire to point out to dairy farmers the following advantages of being connected with such a centre :—

1. *Surplus milk in April, May and June* can be made into Cheddar cheese. This enables farmers, usually, to not only secure a better price for their surplus milk, but also to obtain better terms from their retailers for their remaining milk.



2. The factory will be able to deal temporarily, at contract time, with unsold milk, thus enabling members to make the best possible terms concerning their milk.

The guarantors in connection with the above would point out that during the past season the centre has been very helpful to them and that instead of the guarantors receiving the prices of 10½d. and 7½d. payable for surplus milk in May and June, it is hoped that the guarantors will share out at the rate of 1s. per gallon.

The following are necessary rules and conditions in connection with the Lewes centre.

Guarantors must subscribe towards the rent and general expenses in connection with the centre at the rate of 2s. per cow, 1s. to be paid on the 1st October, and the balance on the 1st April, with a maximum of £5.

From the guarantors will be elected a management committee to deal with the work of the centre.

The management committee reserve the right to accept, or decline, surplus milk. Should they be unable to accept milk any subscription paid will be refunded.

*The guarantors of the Lewes centre wish to point out that they have already equipped the centre and have obtained an option of a lease of the premises and, further, that as regards any additional equipment which may be necessary to deal with larger quantities of milk, a guarantor has advanced £100 for such equipment, which can be repaid from proceeds received at the centre extending over a period of three years.*

The guarantors desire also to point out to dairy farmers *that during the past season they have dealt with approximately 9,000 gallons of milk at Lewes*, that there are similar centres run by the Hassocks and also by the Steyning Branches of the Farmer's Union. By supporting such centres dairy farmers will be rendering invaluable assistance to the dairying industry in East Sussex."

The guarantors of the Lewes scheme were confident that they could largely increase the number of members who would now support the Co-operative Centre, but they wish to have the benefit of another year's experience before embarking on what will ultimately undoubtedly be a much wider scheme of co-operation between milk producers.

In connection with the Lewes cheese centre, one of the most gratifying things has been the ready assistance of the local branch of the Women's Institute in disposing of much of the cheese made.

In the meantime, the work which had been carried out by the Hassocks Branch of the National Farmers' Union had aroused the interest of the adjoining branch at Steyning, which comes within the administrative county of West Sussex. At the commencement of the establishment of this centre, a student who had been trained in cheese-making at the county farm at Plumpton, carried on the centre until other arrangements could be made.

The cheese-making centres of Sussex which have, during the last few years, grown from such a small commencement, have not necessitated any large amount of capital expenditure to be borne by members. The buildings invariably have been of the simplest kind, whilst the amount subscribed under the Lewes scheme is such that farmers generally are willing to subscribe to it as an insurance policy enabling them to deal with surplus milk.

Further, such centres are not inimical to the interests of the retailers of milk; as a matter of fact two of the most prominent supporters are amongst the largest distributors in Sussex.

Since the movement has extended from Plumpton to the Hassocks, Lewes and Steyning Branches of the National Farmers' Union, it is the intention of the Agricultural Education Committee to foster similar centres throughout East Sussex wherever such can be established, as the Committee feel that no better assistance can be given to milk producers in this time of stress than enabling them, by providing technical instruction, to deal co-operatively with milk, on which so largely depends the prosperity of the agricultural industry in Sussex.

**Ministry's Scheme of Assistance.**—The development of cheese-making centres in Sussex could not have been carried out but for the assistance received in connection with the Ministry's scheme for aiding the formation of co-operative cheese schools.

It is probable that this scheme is known in most counties, but it may be useful to give a brief outline of it.

The Ministry, with the object of providing local demonstrations of the possibilities for co-operative action by milk producers, and of giving instruction in certain branches of dairy technique, has urged County Agricultural Education Authorities in whose area milk production is practised to any considerable extent, to conduct co-operative dairy schools at suitable centres where the local milk producers express a desire for assistance. A school located at an approved centre would operate for from three to six months, or until an adequate demonstration has been provided.

The local milk producers must agree to contribute on a co-operative basis for the use of the school, a daily quantity of milk—usually fixed at about 200 gallons, and must appoint from amongst themselves a local committee of management to act under the guidance of the agricultural organiser and the school instructor.



The Ministry lends to the authority most of the equipment, and contributes two-thirds of the instructor's salary and of other expenses incidental to the instruction. The Ministry's technical staff is also willing at all times to assist with technical advice.

It is of course not required that the farmers taking part in the demonstration shall subsequently form a co-operative society. They are left to form their own decision in the light of the results of the school.

It is not the purpose of this article to deal fully with the scheme, but all interested in such work are advised to apply for information to their County Agricultural Organiser or to the Ministry.

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## CONSTRUCTION OF SILOS.

WALTER E. SAWYER.

Of late there has been much discussion on the cost and style of various silos, and it is felt that particulars and illustrations of certain types of silos may therefore be of some interest. With the exception of the last (Fig. 2), which was built of blocks and was put out to contract, all these silos were designed and built under the personal supervision of a thoroughly practical farmer, farming his own land. As regards the labour, that, too, was all untrained. The first silo was built with German prisoner labour, and without the use of scaffolding of any kind, but an internal ladder and jenny wheel. The others were built by men usually at work on the farm. The scaffolding used was suitable timber usually available on an ordinary farm.

Owing to varying wages the cost is given in hours or days, and materials in quantities, so that it is quite simple to work out the total cost at the present price of labour and materials.

The first silo illustrated (Fig. 1) was built with German prisoner labour, *in situ*, with forms 2 ft. 3 in. by 12 ft. 6 in. and 8 in. thick. The material used was 12 tons of cement and 60 yds. of shingle and sand. The mixture used was 1 part of cement, 3 parts of sand and 4 of shingle, reinforced both ways with old iron. It was built at the rate of three rings per week, to allow of the proper setting of the concrete. The bottom is drained and stands on gravel. The average labour was 5 men per day. The entire quantity of material was hoisted by a jenny wheel attached to a ladder inside. The total height is 40 ft. and diameter 16 ft., with an approximate capacity of 180 tons. This silo has a slightly domed top and openings at intervals at

the side, covered by a chute of galvanised iron, so enabling the silage to be thrown out as wanted, directly on to a wagon or tumbril. A fixed ladder runs the whole way up, joined to the silo within the chute. The material as cut goes up through an iron tube to the top of the silo, through a hole, and is then directed downwards from the centre through a flexible iron tube, so that it is equally distributed all over the floor. In practice, as the silo is being filled a man treads the material down as it is delivered out of the spout, and by directing the flow, keeps the material evenly pressed and prevents any looseness near the walls, which might allow of deterioration of the silage.

The actual filling of the silo is carried out by an ordinary Maynard chaff cutter adapted for the purpose. The knife delivers directly into a sunken receptacle with a blower attached which forces the cut stuff up the delivery pipe and through the hole in the top into the silo. The crop used in this case was from a mixture of 5 pecks of tares and 3 pecks of oats per acre, which yielded about 13 tons per acre. The filling took place continuously, only the nights and Sunday being left for settling, the amount dealt with being about 30 tons per day. Usually the silage is left for three months before being broached and then is fed to cattle and other stock. The owner considers the relative value of this silage for rough comparative purposes as roots 100, silage 175, or hay 100, silage 33. The amount of waste entailed by making the silage and through loss of weight is reckoned as about 5 per cent. of water and 3 per cent. outsides, tops, etc.

The second silo (Fig. 3) was built under exceptionally economical conditions. On the estate, within a few hundred yards of the farm premises and on the way to the town, there is a gravel pit. By cutting away back to a perpendicular straight wall it was possible to erect a 15-ft. silo, which could be filled from the top and emptied through the various side openings or windows into carts or waggons when required. In this case the rough sand and shingle were obtained as the site was excavated. The particulars of this silo are:—Height 15 ft., diameter 12 ft., capacity about 3,000 to 4,000 bushels of wet grains. This silo was built by two men in 24 working days. The forms used were 1 ft. 6 in. by 3 ft., making walls 4 in. thick and one ring every 24 hours. The mixture used was 1 part cement, 3 parts sand, 4 parts shingle, reinforced with old iron. The total cement used was 2 $\frac{3}{4}$  tons. As the sand and shingle came from the excavation and the labour is included in the 24 days of the whole work entailed of excavating, building, water carting, etc., this was



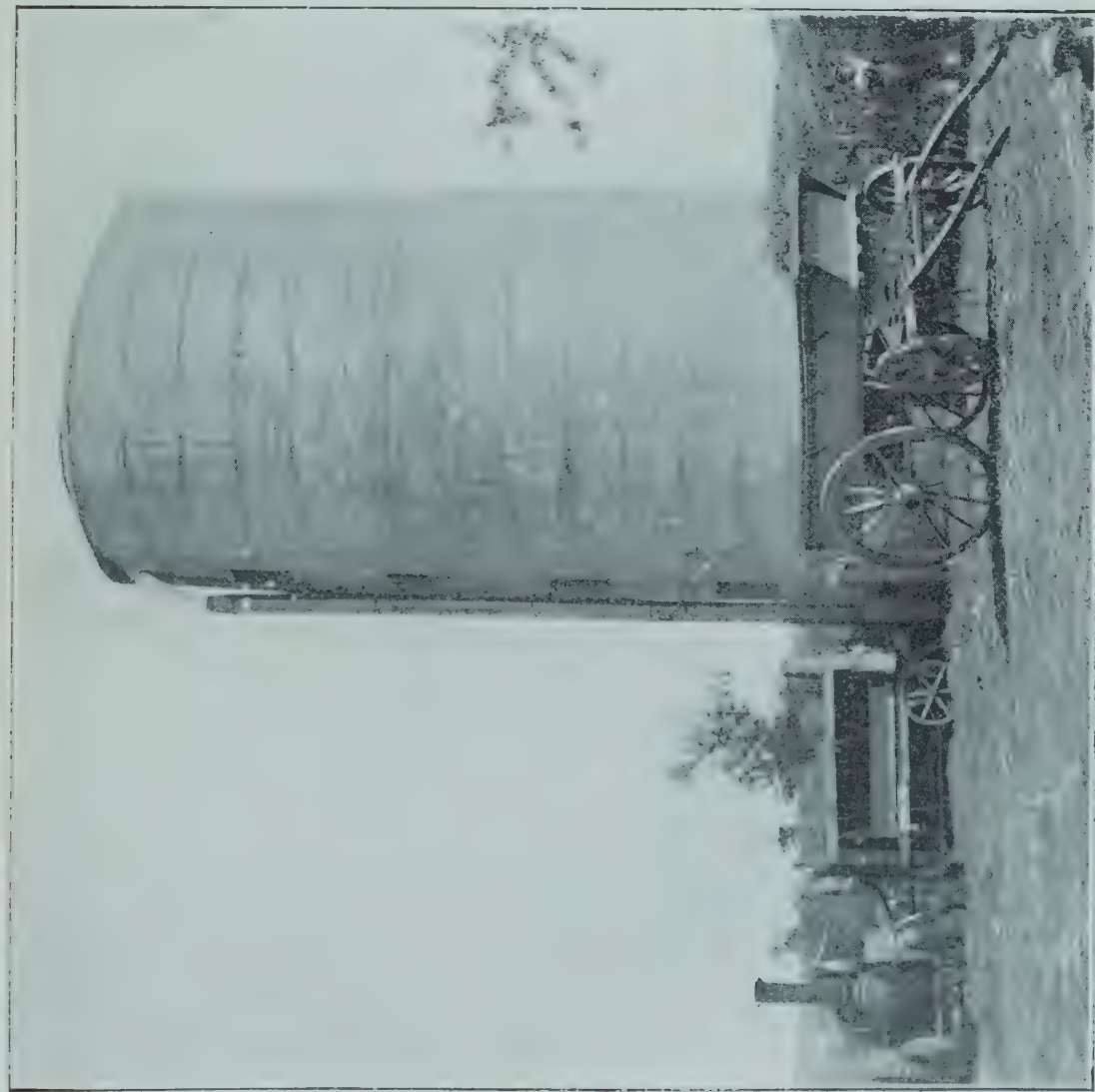


FIG. 1.—Reinforced Concrete Silo at Brundon.

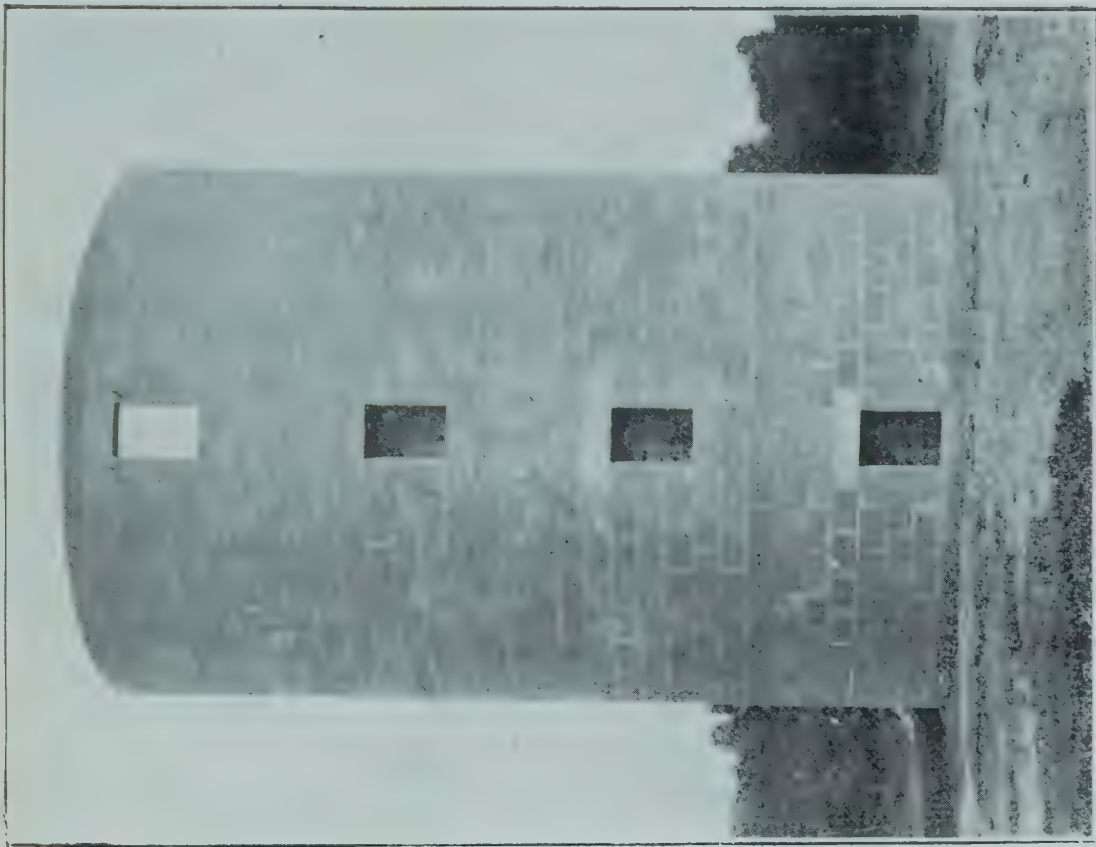


FIG. 2.—Concrete Block Silo at Belchamp.



FIG. 3.—Reinforced Concrete Pit Grain Silo at Brundon.



FIG. 4.—Reinforced Concrete Water Tank at Brundon.



a very cheap silo. There are three windows or openings for emptying the silo. In this case the bottom is solid cement without drainage.

The grains ensiled here are bought during the cheap period when flush of grass makes them practically unsaleable, and stored for use during the winter months. The shrinkage, principally water, is about 10 per cent. The grains are used for cows, partly to replace concentrated food at the rate of  $\frac{1}{3}$  bushel per day, a typical ration being 50 lb. silage,  $\frac{1}{3}$  bushel ensiled grains,  $\frac{1}{3}$  bushel fresh grains, 3 lb. concentrated food, and 7 lb. dry cut chaff.

Another silo (Fig. 2) was built on an off farm under contract on 1922 costs for £170. It is built of concrete blocks with horizontal reinforcing only. The blocks were made on the site and the mixture was about 5 parts sand and 1 part cement. The floor has drainage, but there is no roof. It is 30 ft. high and has a diameter of 16 ft., with an approximate capacity of 120 tons.

It may be of interest to add a note on the construction of a farm water tank. Fig. 4 gives an idea of how the water supply for the farm and dairy is arranged. In this case a concrete bottom and foundation was built, upon which the walls of the water tank were erected. This tank was built *in situ*, with forms 1 ft. 3 in. by 3 ft., and making the walls 4 in. thick. The mixture used was 1 part cement, 2 parts sand, and 4 parts shingle. The whole work was reinforced with old iron, and one ring was built per day. A top was made with wooden supports to hold the reinforced cement top until dry. The labour was entirely unskilled and, including the raising of sand and carting from a near-by gravel pit, the time taken was 2 men for 12 days. The tank is 8 ft. high, and has an internal diameter of 12 ft., holding approximately 5,700 gallons. The water is pumped in through a hole at the top, and for use is drawn off half-way up through a tap and also through pipes to the horse- and cow-yards and sheds, etc., by gravitation only. There is also a hole at the very base of the tank allowing all the water to be drawn off for cleaning purposes. It is filled by a 3-in. centrifugal pump coupled direct to a De Dion petrol engine which easily fills the tank in 75 minutes, using about three pints of petrol.

The writer wishes to thank Mr. Cecil Whittome, Brundon Hall, Sudbury, Suffolk, for kind permission to publish the photographs illustrating this article.

## THE WORKING OF THE SEEDS ACT, 1920.

DURING the season 1922-23 9,000 inspections under the Seeds Act, 1920, have been made by the Ministry's outdoor staff. These inspections have included the premises of the large wholesalers, the retailers' shops, shops where seeds are sold merely as a sideline during a limited period of the year, markets, auction-marts and farms.

With the exception of certain points which will be referred to in detail below the Regulations now appear to be thoroughly well understood by the majority of seedsmen, and are being complied with in a satisfactory manner.

**Control Samples from Bulk.**—The number of control samples taken from bulks during the season amounted to 583, and included 159 samples of clovers, 105 of grasses, 11 of field seeds, 49 of roots, 241 of vegetables and 18 of cereal seeds.

67 of these samples, mainly clovers and grasses, showed as a result of the official check test, that the declarations made by the sellers were incorrect in some material particular. In 19 cases the germination differed by from 10 to 15 per cent., 6 differed by from 15 to 20 per cent. and 9 were wrong to the extent of over 20 per cent. in the germination figure. In 6 cases the purity was shown to be from 3 to 5 per cent. out, another 6 differed by from 5 to 10 per cent., and there was one case in which the purity was declared as more than 10 per cent. higher than was shown by the check test. The principal sources of error in the remaining cases were omissions to state the presence of dodder in clover, and incorrect statements as to the presence of injurious weed seeds. In all cases where the check test showed a marked discrepancy from the vendor's particulars, the matter has been taken up with the person concerned.

**Packeted Seed.**—A notable improvement is shown in connection with the small packet trade. It would appear that the Act is having the effect of gradually driving the greater portion of this class of trade into the hands of a few big firms who understand what is required of them and who are distributing good quality seed. Of the 260 control samples of packeted seed taken during the past season 88·9 per cent. were shown by check tests at the Official Seed Testing Station to be at or above the minimum percentages of germination and purity laid down in the Regulations; 3·8 per cent. were below the minimum but above two-thirds; and the remaining 7·3 per cent. were below



two-thirds of the minimum. Most of the samples falling within the latter group were of packets taken on the premises of small sideline dealers which had been carried over from previous seasons. Appropriate action has been taken by the Ministry in all these cases.

**Licensed Private Seed Testing Stations.**—Tests for the purposes of the Seeds Act, in the case of seeds other than garden seeds, must be made at one of the official testing stations, or at a station licensed by the Ministry for that purpose. The total number of licences issued to date for this purpose in England and Wales is 84, and includes 29 to test all kinds of seeds covered by the Act, 4 to test all kinds of seeds except grasses and clovers. 1 to test clovers, ryegrass, cereal and field seed, 7 to test field and cereal seeds, 5 to test field seeds and 38 to test cereal seeds. Of these licences 16 have been issued since August, 1922, and include twelve for testing cereal seeds only.

One of the greatest difficulties experienced in administering the Testing of Seeds Order, which was the forerunner of the Seeds Act, arose from the variation in the results of tests carried out by the various analysts. By confining testing for the purposes of the Act to official and licensed stations this difficulty has been reduced to an appreciable extent, but there is still a considerable amount of divergence in results which causes trouble both from an administrative and a commercial point of view. Up to the present a certain amount of freedom has been allowed to these licensed stations with regard to the methods they employ for testing, but it is increasingly evident that a much higher degree of uniformity in methods is necessary in order to obviate discrepancies in results between the various licensed stations and between these stations and the official stations.

In order to check the results of tests carried out at licensed stations the Ministry has taken from these establishments, during the past season, some 670 special samples. The check tests carried out at the Official Station have shown that in 20 per cent. of these samples, discrepancies have occurred—mostly in the percentage of germination—greater than the prescribed limits of variation. In fairness to the licensed stations, however, it should be pointed out that Inspectors are naturally inclined to draw samples of those kinds of seeds, such as oats, trefoil, mangolds and peas, which are known to give varied results, so that so large a percentage of discrepancy as 20 per cent. would not hold for all the tests carried out at these establishments.

At a well attended conference of official and private seed analysts held at the English Official Seed Testing Station on the 10th August, 1923, this question of discrepancy in results and the importance of uniform methods of testing being employed was discussed in great detail and it is hoped that, as a result of this conference, a series of instructions for testing will be laid down which will considerably reduce the variation in results at present obtained.

As a further means of securing uniformity in methods and results it is intended that the Official Seed Testing Station shall from time to time issue to all licensed stations appropriate samples of seeds for comparative testing. The results of all these tests will be collected and examined and recommendations made for changes in methods, consistent with the evidence produced.

Another step towards uniformity is to require that all analysts in charge of licensed stations shall take one of the courses in seed testing which are arranged for at the Official Seed Testing Station each summer.

The variation in results obtained at different stations is not confined to this country alone, but is a difficulty which is met with in all countries where seed testing is carried on. This problem received considerable attention at the Third International Seed Testing Congress held at Copenhagen in 1921, and has since been the principal study of the "Association of Seed Analysts and Seed Control Organisations of Europe" which was formed at that Congress.

It is of interest to note here that the Fourth International Seed Testing Congress is to be held in London and Cambridge in July, 1924. A Committee appointed by the Ministry is making the necessary arrangements, and invitations to send official delegates to the Congress have already been issued to all the principal foreign countries and to the British Dominions and Colonies.

**Cereal Seeds.**—Opinion remains divided as to the desirability of cereal seeds being included amongst the kinds of seeds covered by the requirements of the Act, and considerable difficulty is met with in the administration of the Act in this connection. It is unfortunate that the circumstances under which a large proportion of the sales of cereal seeds are effected are such that it has been found necessary to authorise a delay of up to a month in the delivery to the purchaser of the statement as to quality.

It seems clear, however, that it is better that the purchaser should receive particulars as to the quality of the seed a week



or so after the seed itself has been delivered than that he should be supplied with no particulars whatever.

The commonest argument against the inclusion of cereal seeds is that anyone with experience in handling seed corn can estimate its capacity for germination by eye with sufficient accuracy for practical purposes. Numerous tests at the Official Seed Testing Station show, however, that cereal samples are extraordinarily deceptive as regards their germinative capacity, many plump good looking samples giving germination results of as low as 40 per cent., while many samples of poor shrivelled and bad coloured grain have given results well above the minimum percentage prescribed by the Regulations.

**Seed Potatoes.**—Next to cereal seeds, seed potatoes give the most trouble as regards the administration of the Act. To a great extent the reason for this is that seed potatoes are sold during a very short period of the year by a very large number of small traders, and it is consequently extraordinarily difficult to keep in touch with this trade. In practically every case investigated the necessary statement required under the Act, viz., the class, variety, size and dressing, appeared on the invoice supplied by the merchant, but either through ignorance or carelessness the small retailer frequently neglects to display these particulars alongside seed exposed for sale or to deliver a written statement to the purchaser in the case of a sale.

It has been suggested that the Act should not apply to sales of small quantities of seed potatoes of less than 112 lb. It is considered, however, that it is just this class of purchaser, the allotment holder and gardener, who buys his seed in small lots, who requires the protection of the regulations. The big buyer has more experience and is less easily fobbed off with unsuitable seed. A frequent source of trouble is the practice of merchants passing on orders to a grower for direct delivery to the purchaser and not taking sufficient care to ascertain that the particulars as to class, variety, size and dressing are accurate. It is suggested that merchants in their own interests, should take such steps as are necessary to see that the potatoes loaded by the grower correspond with the description given to the purchaser.

**Sales by Auction.**—Large quantities of seed potatoes are sold by public auction, and difficulty is experienced from time to time in getting the necessary particulars displayed and delivered. As a general rule auctioneers are very helpful in this respect in pointing out to the sellers the requirements of the

Regulations. The auctioneer, however, is acting merely as an agent for the seller and is, therefore, not directly responsible for the necessary declaration. It should be clearly understood that a sale of seed potatoes by public auction is affected by the Seeds Regulations to exactly the same extent as a private sale.

**Propaganda.**—In addition to the normal practice of distributing a large number of leaflets describing the Act, arranging for lectures at meetings of farmers, etc., efforts are now being made to get into touch with farmers by means of a special seed exhibit at a number of Agricultural Shows. The interest displayed in these exhibits has been very encouraging, and it is believed that this is one of the best methods of bringing home to the farmer the necessity of sowing only tested seed and thereby checking the practice of direct farmer to farmer sales of untested seed, which is so undesirable, but so difficult to prevent.

**Distinctive Name of Variety.**—The Seeds Regulations (Reg. 3 (1) (c)) require in the case of a sale, or exposure for sale, of Cereals, Red Clover, White Clover, Crimson Clover and Sainfoin, that the distinctive name of the variety of the seeds must be declared, or if the distinctive name of the variety is not known, or the stock is mixed, a statement must be made to that effect.

In practice this Regulation is generally complied with, except in the case of Red Clover, in connection with which much regrettable confusion exists. Red Clover is variously sold as "Red Clover," "Cowgrass," "Single Cut Cowgrass," "Perennial Red," "Giant Hybrid Cowgrass," "Late Flowering Red," "Common Red," "Broad-leaved Red," and "American Mammoth."

There are, however, only two distinctive varieties of Red Clover, one the Early or Broad Red Clover which is favoured for its production of spring and winter growth and for the good aftermath, and the other the Late Flowering Red which is the more persistent variety and therefore most useful for long duration leys or for permanent pastures. As these two groups are so clearly defined and each has its own particular characteristics and value there is no excuse for the present multiplicity of names. Moreover it is of the utmost importance that the farmer should know the type of seed he is buying.

**Country of Origin.**—It is beginning to be realised that valuable as is the information required to be disclosed in the case of a sale of seeds as regard the purity and germination, these particulars are only preliminaries when the importance of



variety, strain and nationality are considered. The Seeds Act requires the country of origin to be disclosed in the case of a sale of clovers and grasses, but it is probable that too little weight is given to this information. When considering the quality of a lot of seeds the farmer is well advised to look to the country of origin in the first place, and to examine the figures as to germination and purity in the light of this information. When given the choice between a lot of red clover seed grown in America or France or Italy with a high percentage of purity and germination on the one hand and a lot grown in England or Wales with a germination and purity of a lower percentage than its foreign rival on the other, the farmer is well advised to choose the latter as it will almost certainly give him a more satisfactory crop. No tests can specify the constitution of the seed, but all trials indicate that home-grown seed furnishes a higher proportion of plants capable of standing the winter under our conditions of soil and climate.

It is said that one of the results of the Seeds Act is that too much attention is being directed to germination and purity, and that consequently home-grown seed which in many cases cannot compete with foreign seed as regards purity, germination and appearance, is becoming less popular with the farmer and, as naturally follows, with his supplier the seedsman. Too much stress, therefore, cannot be laid on the distinct advantages of using home-grown seed even though it may show a lower percentage of germination and purity.

In this connection it is of interest to draw attention to the two Associations recently formed in Wales, the "Vale of Clwyd Red Clover Growers' Association," and the "Montgomeryshire Welsh Clover Growers' Association," particulars of which were given in this *Journal* for September, 1923. The main object of these Associations is to foster the growth of the two special strains of red clover grown in these districts, to provide for the certification of the true strains and the testing of the seeds under the Seeds Act.

**Prosecutions.**—Legal proceedings for infringements of the Seeds Act have been taken in 9 cases during the season 1922-23. A summary of these cases is given below.

In June a Portsmouth firm of seedsmen were prosecuted for selling packets of vegetable seed bearing labels which indicated that the seeds were up to the authorised minimum standard of germination prescribed by the Seeds Regulations, but which, on being tested, were found to be much below the prescribed figure. Four separate summonses were issued, one in respect of each of the samples taken, and a fine of £1 was inflicted in each case with a total of two guineas costs.

A local tradesman, who deals in seeds as a side-line, was brought up at Beaumaris Petty Sessions on 30th June on charges of (1) failing to deliver to

an Inspector who took a sample of seeds a copy of the particulars declared with regard to purity and germination, and (2) exposing the seed for sale without a statement of these particulars being displayed on or near the seed. The first summons was dismissed on payment of costs, but a fine of 10s. 6d. was imposed on the second charge, and an advocate's fee of a guinea was allowed.

A similar case against an Anglesey shopkeeper was heard at Valley Petty Sessions on 9th July, the charges being identical with those in the case previously mentioned, the defendant was fined the sum of 5s. in respect of each charge.

On 16th July, a case was heard at Llangefni when the defendant, a local draper and seed merchant, was convicted of failing to deliver to the Inspector who took the sample a copy of the particulars with regard to the purity and germination of a parcel of yearling seed which had not been re-tested. A fine of 10s. was imposed in this case.

At Dolgelly a summons against a firm of general storekeepers was heard on 24th July, the charge being the same as that in the preceding case. The defendant pleaded ignorance, but the prosecution was able to show that attention had been particularly called to the requirements of the Act a year previously, and a conviction was obtained, the defendant being fined £2 10s. and a guinea costs.

A prosecution for failure to deliver a statement showing the prescribed particulars in the case of a sale of seed potatoes was heard at Stratford-on-Avon on 1st August. The sale was a cash transaction, and the defendant took the line that the potatoes were not sold as seed. It was possible, however, to convince the Bench that they were, in fact, sold for planting, and a fine of 10s. was imposed.

On 25th August at Colwyn Bay Police Court a charge of making a false statement in connection with the sale of packets of seed was heard. The seed in question was parsnip which was guaranteed to germinate to not less than the minimum percentage mentioned in the Seeds Regulations. On being tested at the Official Station, however, it was ascertained that the seed was dead. A fine of £1 was inflicted in this case and an advocate's fee of a guinea was allowed.

Two charges were heard at Bangor on 4th September against a Llanfairfechan tradesman in respect of (1) failure to display the prescribed particulars in respect of seed exposed for sale, and (2) making a false statement with regard to the germination of seed. On the first charge, which was based on a Control Sample taken by an Inspector, the defendant was fined £1, and 1½ guineas advocate's fee was allowed. In the second case, however, the packet of seed in question had been purchased on behalf of the Inspector by a private individual, and the defendant was able to claim that some doubt existed as to whether the seed tested was, in fact, that purchased from him. The summons was, accordingly, dismissed on payment of costs.

A charge of making false statements in connection with the sale of three consignments of seed potatoes was heard at Chatteris on 4th September, the defendants being a well-known local firm of seedsmen. Samples of the three consignments had been taken by an Inspector from a shop in Oundle in March and grown on at Ormskirk, the results showing that the variety had been wrongly described in each case. A fine of £3 was inflicted.



A firm of seedsmen were prosecuted at Taunton on 5th September, the charges being (1) making a false statement respecting a sample of trefoil seed, and (2) failing to deliver to the Inspector who took a sample of red clover seed the prescribed statement. In the first case it was admitted by the defendant that a certain amount of yearling seed had been added to the sack from which purchasers were supplied, and that the particulars he was declaring were those supplied to him in respect of the new seed. A fine of 10s. was imposed in this instance. On the second charge the defendant pleaded that he had omitted by an oversight to have the seed re-tested, and as the seed was found to be of good quality the Bench dismissed the summons on payment of two guineas costs.

**Amendments of Seeds Regulations.**—No amendments have been made in the "Seeds Regulations, 1922," so that, unless some unforeseen circumstances should arise, the Regulations will be the same during the season 1923-24 as those which were in operation last season.

Copies of the Seeds Act, 1920, and of the Seeds Regulations, 1922, may be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C., price 3d. each.

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## THE CONTROL OF APHIDES ATTACKING SPROUTING POTATOES.

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IN a recent paper\* F. V. Theobald describes the species of aphides (green flies or plant lice) attacking potatoes in this country, three of which have occurred on sprouting tubers, and it is stated that such attacks are frequently severe. The species concerned are *Macrosiphum solanifolii*, Ashmead; *Myzus persicæ*, Sulzer, and *M. pseudosolani*, Theobald. In January, 1921, the writer investigated a severe attack on boxed sets at Holyhead, and has since found that similar cases are by no means rare. The species in all these North Wales cases has been *M. persicæ* (of a form named by Theobald *tuberoscellæ*, but now regarded by him as merely a variety of *persicæ*). This common species occurs on a considerable number of host plants, both out of doors and under glass, as well as on the potato, and is one of the species accused of transmitting diseases of the virus group. It was taken on field potatoes in small numbers in 1922, and has been fairly common this season (1923), especially

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\* "The Aphides attacking the Potato," F. V. Theobald, S.E. Agric. College, Wye, 1922.

in some sheltered gardens. The strain of aphides obtained at Holyhead has been maintained in the laboratory at Bangor on sprouting potatoes, and a number of observations have been made as to its habits, etc., while some experiments have been conducted with the object of determining a method of control at once easy of application and harmless to the sprouting tubers.

**Breeding Experiments.**—*M. persicæ* breeds very rapidly on boxed potatoes throughout the winter under sheltered conditions, and not only causes shrivelling of the sprouts, but coats the tuber with sticky "honeydew" to which adhere the cast skins of the insects. On 23rd January, 1921, at Holyhead, well-sprouted tubers of Sharp's Express, Ally and Majestic were smothered with all stages of the pests, while winged females were abundant. Many varieties have been tried, and all appear equally liable to attack. On 7th November, 1922, a few viviparous females were transferred from shrivelled tubers to the young haulm of potatoes grown in pots, and by 4th December, dense colonies had formed, and the young shoots were withered and nearly dead, while winged forms were produced by 6th December. On the 11th December single apterous females were moved to sprouts of several varieties of tubers, and colonies were forming on the 25th, while by 10th January, 1923, the infestation could be described as "heavy" and a few winged forms were to be seen. These winged aphides fly to the nearest window, where they congregate in hundreds, but if placed on fresh potato sprouts they will frequently settle down and produce colonies.

During the period mentioned above the temperature of the laboratory varied considerably, going as low as 46.5 deg. F., and as high as 61.5 deg. F. Another series on Dargill Early was tried in an unheated room. Ten tubers were colonised with a single female each on 10th January, 1923, and on 18th January showed increases ranging from 7 to 15 larvæ (with an average of 10). Other females placed on Sharp's Express on 11th January, each produced from 3 to 8 young by the 18th January.

Removal of aphides from sprouts to foliage succeeded in the laboratory, but not under garden conditions in May, 1922, under unusually fine warm weather conditions, and only to a slight extent in May, 1923; but plants infected on 25th May showed numerous larvæ by 16th June.

In January, 1923, several hundred sprouted tubers were obtained from the College Farm, and colonised with *M. persicæ*,



and these were used for a series of experiments on the control of the aphides.

In 1922 and 1923 series of heavily infested tubers were planted at various stages of attack. If the attack has not been of too long duration, good plants result; but if the sprouts become shrivelled, only weak plants are produced, while in some instances death follows planting. Planting kills the aphides; in only one instance (May, 1923) was a single aphid found on a plant grown from an infested tuber, although forty such were examined.

**Control Experiments.**—For control, fumigations with a preparation containing tetrachlorethane were tried; also paradichlorbenzene (crystal and fluid), and a nicotine sulphate dust containing 5 per cent. of nicotine sulphate (40 per cent. black leaf) equivalent to 2 per cent. of pure nicotine.\* The tubers were examined after treatment and again 48 hours later, and were finally planted in a garden in the ordinary way in order to observe any effects of treatment on subsequent growth. Preliminary tests were made with a few tubers planted in pots.

All the substances used killed the aphides, but in the case of paradichlorbenzene several hours' exposure to the fumes was required to kill all the insects, owing to the temperature being too low to allow of the gas being fully effective.† The tetrachlorethane preparation killed rapidly at ordinary laboratory temperatures (between 50 and 60 deg. F.), the exposure being reduced to one hour and being quite effective then.

The nicotine sulphate dust was applied by means of hand bellows, two or three puffs sufficing for a box of tubers. The aphides were affected almost at once, and few survived half an hour after treatment.

The following series were planted, 106 tubers in all:—

- I. 16 tubers of Sharp's Express heavily infested with *M. persicæ*, and exposed to the fumes of paradichlorbenzene for 4 hours at 54-56 deg. F., 4th April, 1923.
- II. 30 tubers of Sharp's Express, heavily infested, and exposed to fumes of tetrachlorethane for one hour at 52-56 deg. F., 3rd April, 1923.
- III. 30 tubers Sharp's Express, heavily infested and dusted with nicotine sulphate at 52-56 deg. F., 26th March, 1923.
- IV. 30 tubers Sharp's Express, heavily infested, planted without treatment.

On 24th May all these were carefully examined and all were up.

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\* The writer is indebted to Messrs. Murphy & Son, Ltd., for kindly supplying this dust.

† "Paradichlorbenzene as an Insect Fumigant," A. B. Duckett, U.S. Dep. Agric., Bull. 167, 1915, p. 2.

The first and second lots were markedly backward and weak, as compared with the rest; some being barely above the surface, and none more than 5 in. in height.

Lot III, treated with nicotine sulphate dust, and the untreated lot, were for the most part strong and vigorous, with here and there a backward one (due to the weakening effects of aphid attack), and were from 4 to 8 in. in height. The crop was raised and weighed on 26th July, with the following results:—

- I. 10 plants from tubers fumigated with paradichlorobenzene yielded a total of 2 lb. 9 oz., a marked feature being the large number of very small tubers.
- II. 10 plants from tubers fumigated with tetrachlorethane yielded 4 lb. 4 oz.
- III. 10 plants from tubers dusted with nicotine sulphate yielded 8 lb. 6 oz.
- IV. 10 plants from tubers not treated prior to planting yielded 8 lb. 6 oz.

The relatively low yield must be attributed to the results of aphid attack; while the effects of fumigation with paradichlorobenzene and tetrachlorethane may possibly have been intensified by the previous severe injury by the aphides. It may be mentioned that Speyer\* has noted that fumigation experiments with tetrachlorethane showed remarkable variations as regards the susceptibility of certain plants to injury by it. Further investigation is required in this connection. It should be noted that the tetrachlorethane used was not pure, but a proprietary preparation.

It might appear, from a casual examination of the results, that, although nicotine sulphate effectively killed the aphides, there is no advantage in the treatment, as the crop from the treated tubers was no better than that from untreated seed. This is hardly a fair conclusion. Both treated and untreated seed had, before planting, been seriously weakened by the aphid attack, and had the nicotine sulphate been applied when the attack commenced, say in January (instead of April), the results might have been very different.

When the presence of aphides is noted on sprouting potatoes, treatment should be undertaken at once, as the earlier this can be applied the better, before the aphides have had time to weaken the sprouts. Potatoes intended for seed should therefore be examined from time to time, as the attack may easily escape notice, especially in the early stages. Later the pale cast skins of the insects adhere to the sprouts, drawing attention to their

\* Speyer, E. R., Rept. of Entomologist, 8th Ann. Rept., 1922, Expt. & Res. Sta., Cheshunt. (Rev. Appl. Entomol., XI. A., p. 47, July, 1923.)



presence, and still later marked shrivelling is seen. Treatment by means of the 5 per cent. nicotine sulphate will prove most effective on potatoes sprouted in boxes, etc., in single layers (as in the case of the experiments here described). The tubers are thus freely exposed to the fine dust, and a considerable quantity can be dealt with rapidly and effectively by means of hand bellows, sulphurator, etc.

\* \* \* \* \*

## “SCORCH” OR GLOEOSPORIUM DISEASE OF RED CLOVER.

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OWING to the autumn and winter of 1922 in the South-East of England having been damp and unusually mild, severe outbreaks of the disease known as stem rot or clover sickness, caused by the fungus *Sclerotinia trifoliorum*, became widespread through numerous crops of red clover. As a result of this attack, many fields of red clover by the spring of 1923 were reduced to such a patchy condition that it was an open question as to whether they should come under the plough; frosts and dry weather, however, prevented further damage by the fungus and the majority of thin “plants” produced, by the middle of May, a promising growth.

By this time, however, a further trouble had arisen and complaints were received, up to the time of cutting in mid-June, that the crop was suffering from a disease of a very different nature which resulted in blackening and breaking of the stems and withering of the leaves (Fig. 1).

Such damage resulted that in the majority of cases fresh stems from the crown, which should normally provide the second cut, had grown up prematurely to replace the brown stems and brittle leaves of the first cut, and the two were mown together in June.

The growth of fresh green stems and leaves at the time of cutting gave the impression that the crop had partly recovered, but it is important to realise that substitution of diseased stems by fresh growth played an important part in the apparent recovery, and though the bulk for hay had improved, the individual plants themselves were no more healthy and the second cut suffered accordingly. It has been found in other cases that the second cut may be attacked more heavily than the first.

Examination of affected plants showed the presence of a fungus agreeing closely with *Gloeosporium caulivorum*, Kirch.

The disease, also called "Anthracnose," has been investigated in this country by Miss Sampson and other workers\* and has been described on the Continent and in America where it is apparently more harmful. It was mentioned by the Ministry† as occurring in 1920, and was described as "a usually scarce disease." It was first recorded by Mr. F. R. Petherbridge near Cambridge in 1920, and one crop in that year was known to have been ploughed up after the first cut had been taken. In certain districts in Kent the effects had become so prominent in the early summer of 1923, and the cause remained so inconspicuous, that as a result inquiries were made by farmers. It seems therefore desirable that the present disease should be described in order that the symptoms may be generally recognised.

**Appearance in the Field.**—Throughout the field and particularly in patches, it is noticeable that the upright stems and leaf stalks of the clover are marked with narrow, dry depressions, varying in length from  $\frac{1}{8}$  in. to 3 in. or more, having black margins and lighter coloured centres.

The depressions are either quite shallow, or more frequently a portion of the stem on one side is destroyed and the lesion consequently forms an oblong pit which penetrates to the pith or hollow centre of the stalk; the sides, when dry, tend to roll inwards and so cause the lesion to open slightly. The cavities thus made in the side of the stem might, from their appearance, well be caused by slugs, which are usually plentiful in clover leys, and in some cases the damage was actually attributed to them.

Around the margins of the lesions, and within the cavities, small white pustules of the fungus *Gloeosporium* can be seen with a lens (Fig. 2), but these are at all times very inconspicuous, and are most evident under moist conditions. The fungus, by penetrating the tissues, causes the lesion to increase; a part of the stem is thus destroyed on one side or it may be completely girdled by a more shallow depression and the stalk consequently falls over, causing the death of all leaves and shoots above that point. Similarly the leaf-stalk alone may be attacked and the leaf dies.

\* Sampson, K. "Red Clover: Investigations on Anthracnose due to *Gloeosporium caulivorum*," in *Preliminary Investigations with Herbage Plants*, Series II. No. 1, p. 83, Aberystwyth, 1922. Stapledon, R. G. "Plant Breeding Work at Aberystwyth," *Journal of the Ministry of Agriculture*. XXVII. 7. p. 630, Oct. 1920.

† Ministry of Agriculture. "Report on the Occurrence of Fungus, Bacterial and allied diseases on Crops in England and Wales for the year 1920-1921," p. 44.





FIG. 1.—*Left*: Red Clover plant free from *Gloeosporium* disease. Total length, 38 in.

*Right*: Red Clover plant attacked by *Gloeosporium caulicorum*. Total length, 24 in. Fresh green stems and leaves, arising from the crown, can be distinguished in the centre of the plant. These serve to replace the broken stems and withered leaves which are characteristic of the disease.

(Photographed 22nd June, 1923, at the time of cutting.)

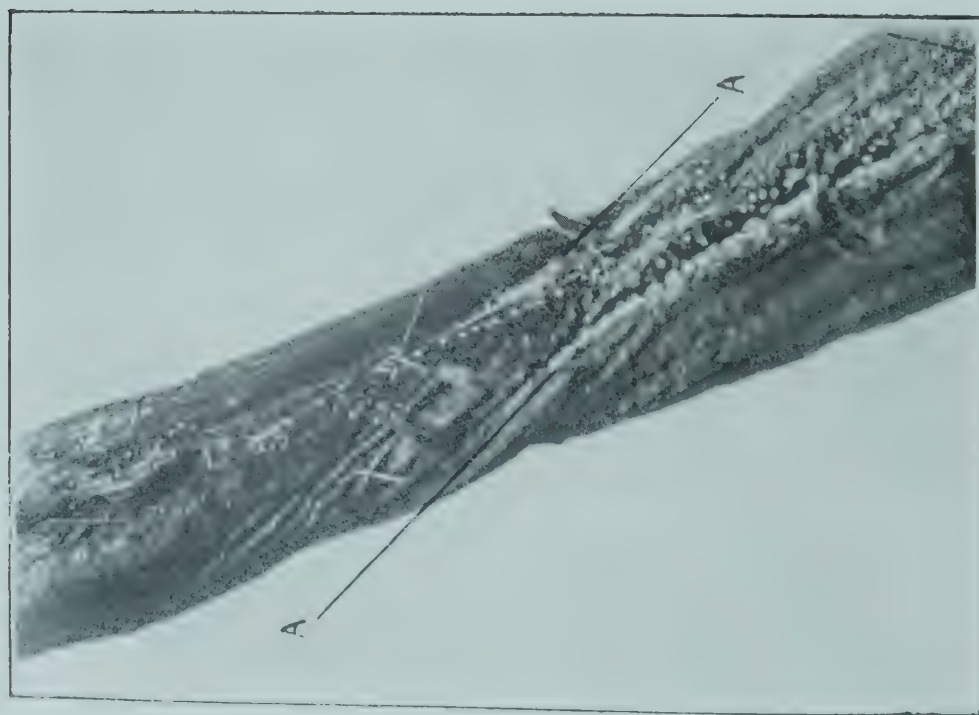


FIG. 2.—Part of a stem of Red Clover showing white pustules of *Gloesporium caulicorum* in lesions at A, A. ( $\times 10$ .)



FIG. 3.—Stalks of the three leaflets of a leaf of Red Clover. Two are attacked by the fungus *Gloesporium caulicorum*, and the third is free from disease. ( $\times 10$ .)



Occasionally the three short stalks of the leaflets of one leaf are infected, with the same result (Fig. 3). The white pustules of the fungus which appear on the lesions, produce masses of minute spores\* which may be carried by insects, wind or rain, to cause fresh infection in other parts. It is possible that infection of the leaflet stalks, as shown in Fig. 3, may be materially assisted by moisture. Water from the leaflet blades, possibly carrying with it spores of the fungus, often being held on these stalks in the form of a drop.

Stems and leaves which are killed become so withered, dry and brittle that much leaf is lost, and, as a result, the hay is of poor quality. The clover field, as a whole, appears as though scorched. As described above, fresh growth from the crown may replace some of the loss, and in the instances observed in June, 1923, this second growth was little attacked. As illustrating the severity of the original outbreak, in one case a farmer described his first cut as consisting largely of the second.

**Resistance to the Disease.**—It has been noticed this year, in six small trial plots of red clover grown side by side at Wye, that English broad red was strongly attacked, but Chilian and English so-called cowgrass and English late-flowering red to a less extent. "Perennialised broad red" was only slightly attacked and on the Danish strain "Hersnap" the lesions were comparatively rare and no broken stems were found. The difference in intensity of attack was most noticeable, particularly because the Hersnap plot was adjoining the English broad red, and though the tall stems of both became intermingled, the Danish strain remained remarkably free from disease.

When examining diseased crops on the farm, it was noticed that individual plants occurred which were free from disease, though these were growing in the midst of others strongly attacked. The plants shown in Fig. 1 were growing side by side in a clover ley; that on the left was entirely free from *Glocosporium* disease.† The above facts appear to indicate that there is definite variation in susceptibility shown by red clovers, and that varying intensity of attack is not due merely to differences in external conditions.

The first occurrence of the disease, however, may be affected

\* The spores were colourless, curved and unicellular, measuring  $10-30\mu \times 4-5\mu$ .

† Another disease, Leaf Spot, caused by *Pseudopeziza trifolii*, was present in abundance on this plant. The characteristic marks on the leaves can be observed in the photograph.

by external conditions, since it is considered possible that spores of the fungus may adhere to the clover seed.\*

Similar variation in susceptibility to *Gloeosporium* shown by red clovers has been described by Miss Sampson,† the late-flowering reds being found relatively free from disease.

Since it is impossible to counteract the fungus when in a grown crop of red clover, it seems that the most promising method of dealing with this troublesome disease consists in selecting resistant strains in so far as the requirements of the farm will permit, but it must be remembered that weather conditions probably determine the presence or absence of this disease in any particular season.

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## STOCKBRIDGE SHEEP FAIR.

A. RUSSELL-SMITH.

STOCKBRIDGE Sheep Fair, as the Hampshire saying goes, is always the best, or the worst, of the fairs in the year. It comes first after the lambing season, and the prices ruling reflect the forecasts of the market conditions of the coming year that have been formed by both the flock masters and the buyers. At subsequent fairs those forecasts have been tested and modified in the light of actual prices, but the first fair of the year is likely to be, out and out, either a seller's or a buyer's market.

The fair owes its origin to a grant made by Henry III in 1221 to William de Briwere, the then Lord of the Borough of Stockbridge and of the manor of Whit Somborne. It was to be held on the Feast of the Apostles Peter and Paul, and on the Vigil and morrow of that Feast. The Vigil of the Feast now falls on the 28th June, but before the Calendar was altered in 1752 it fell on what is now the 10th July. As the lambs could not be ready by the altered date Stockbridge has always kept to the old style and opens its fair on the 10th July.

In 1361 the Borough and Manor passed into the hands of John of Gaunt, who had married a descendant of the Briwere family, and from then until 1824 they were held by the Duchy of Lancaster. So far as the records show the fair has been held yearly since its original grant, and it has played an important part in the sheep breeding industry. It has brought

\* Fulton, H. R. *Pennsylvania Station Report*, p. 249, 1912. Hegyi, Dózso, in *Mezőgazdasági Szemle*, year XXXIII, No. 2. pp. 55—58. Budapest, 1915. Abstract in *Monthly Bulletin of Agric. Intell. and Plant Diseases*. Year VI, No. 4, 1915.

† Sampson, K. *loc. cit.*



the flock masters in the Down country, of which Stockbridge is the natural centre, into direct contact with the actual buyers of Down sheep from all over the country; and it has done this by offering a large selection in both numbers and quality. Of recent years there has been a falling off in numbers, in part attributable to the growth of frequent auction sales, but in the main to the disastrous reduction in the sheep population on the Downs which resulted from over-selling during the War.

The first influence is a continuing one. Frequent small sales at local centres have their conveniences, but there are men of great experience amongst the flock masters who regard them as fatal to the best interests of the breeders, and of but doubtful benefit to the ultimate buyers. Such sales do not offer a sufficient selection in either numbers or quality to make it worth the while of the big buyers to attend, and, therefore, the sheep are generally picked up by the smaller men to sell again at a profit. The result is that at the auction sales the middleman too often makes the prices, and the breeder and the ultimate buyer have to bear between them, as best they may, the middleman's profits.

The second influence that has reacted to the prejudice of the fair, is happily passing. The sheep population of the Downs is increasing as the truth is being driven home that in the Down country it is impossible to grow wheat without sheep. No artificial fertilisers can ever do the work that is done so thoroughly by the "golden hoof." It must take time to re-establish the flocks that were so seriously reduced during the War, but a start has been made.

It was in these circumstances that a meeting of flock masters and others interested in Hampshire Down sheep, held in Stockbridge in February, 1923, resolved:—

1. That it is in the interest of the neighbourhood that the early sales of sheep and lambs should be concentrated at the Stockbridge Sheep Fair.
2. That to maintain quality, it is desirable that prizes be offered at such fair.

The meeting appointed a Committee of representative local farmers to make these resolutions effective.

As the result of the efforts of this Committee, the fair held on the 10th July last showed a marked improvement on those of recent years. Upwards of 2,600 sheep and lambs were penned, or more than double the number offered in 1921 and 1922, but still far below those of pre-War times. There was keen competition for the prizes, which, to the value of £47,

were given by well-known flock masters and others in the neighbourhood for the best pens of pure-bred regular draft ewes, two-tooth ewes, wether lambs, cross-bred wether lambs, pure-bred ewe lambs and cross-bred ewe lambs, and a special prize for the largest penner. In each class there were prizes for the shepherds as well as the breeders. It was possible for any breeder to compete in the classes mentioned, provided he penned his exhibit in the proportion of 20 to every 100 ewes in his flock, nor was it incumbent on him to dispose of his two-tooth ewes or ewe lambs, which he might send, as several did, for competition only. In other respects the ancient character of the fair was maintained, and it was open to all who had sheep to dispose of. One interesting feature worth recording was the encouragement given by the present Lord of the Manor in formally declaring the fair open, accompanied by his bailiff bearing the historic silver mace of the town of Stockbridge.

Flock masters feel that a good start has been made towards re-establishing the usefulness of the fair, and are confident that if the buyers of Hampshire Downs will have a little patience, and in the meantime continue their support, Stockbridge will be able in the near future to offer again a full supply of sheep of the best quality. If this can be done then the fair will fulfil the purpose it has served since it was created 702 years ago: it will enable the breeders in the district, as a whole, to get into direct contact with the buyers on the market wherever they may be, it will broaden out the chances of business by offering a bigger selection than can be found at the local sales, and it will help in avoiding the cost of the middleman.

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## CO-OPERATIVE MARKETING BY SMALL PRODUCERS.

THE advantages of co-operation are now so well understood that it is unnecessary to dwell on them here. Even the largest and most powerful interests find it desirable still further to strengthen their position by combination, and if the small producer is to achieve any useful result it is clear that it can be done only by working in conjunction with and not in opposition to his or her neighbours. The advantages of co-operative working, therefore, are taken for granted. The question is how best to apply the principle to the problem of the



sale of produce. The following notes were originally drawn up for the guidance of Women's Institutes by the National Federation of Women's Institutes, but the principles are equally applicable to any small society undertaking marketing.

The kinds of produce to be considered will usually be fruit, potatoes, vegetables, eggs, poultry and rabbits, with butter and possibly cream and small cheese in some counties. In many parts of England there are now in existence substantial agricultural co-operative societies which provide the farmers with their feeding stuffs, fertilisers, seeds, and other requirements. Though the sale of farm produce is now receiving more attention, much less has been done on that side by the large societies, and it is suggested that small societies could usefully strike out a line for themselves, namely, in endeavouring to supply the smaller towns. Covent Garden and the great industrial towns are and must be catered for by the large grower. Mass consumption demands mass production and it will not pay to place on rail for transport over long distances small mixed lots which will have to compete with the large consignments of high-grade well-packed produce sent forward by the larger growers.

**The Opportunity of the Small Producer.**—Many small country places are much worse provided for than the great towns, and it is a striking fact that much of the produce which is seen in the shops in the smaller towns has been obtained from Covent Garden. Here, then, would seem to be at least one opening for the small producer.

The collection of the produce, its conveyance to the point of consumption and the method of selling will all require to be carefully thought out. Conditions vary so widely in different localities that it is hardly possible to do more than throw out some general suggestions and hints, leaving to a committee on the spot to work out details.

**Studying the Market.**—The first thing to be done is to decide which market is to be supplied, then to study what it needs. There is in this country—and it applies to large producers as well as to small—too great a disposition to grow *something* and to hope that when it is ready it will be wanted. A better plan is to consider what will probably be required by the public and the season's demand and to grow that, and particularly to grow what is likely to be in short supply.

Next, sellers must be taught the necessity of packing attractively, and as far as possible in accordance with best trade

custom. Senders should be taught to visualise their produce after it has reached the point of sale, and to consider what its condition will be by then.

A difficulty will be the number of different varieties of certain things. In the case of co-operative marketing societies receiving produce from many individuals this difficulty is bound to remain, though even here some improvement can probably be effected. If the society can supply seeds and seed potatoes, which may be obtained from the nearest farmers' co-operative supply society, it can then specialise on a few only of the best varieties, and each member can be encouraged to grow as few sorts of each crop as possible.

**Collection and Delivery.**—It can be arranged either for members to bring in their produce to one centre or for the marketing society to collect it. In the first case neighbours can co-operate. In the second a sufficient charge for collection must be made to cover the cost. In one Women's Institute, at Watton, Herts, the plan is for the members to bring their produce to a centre in the village, where it is all picked up by a motor lorry and conveyed for sale to the market town (Hertford), five miles distant, a charge being made to cover this service.

**Methods of Sale.**—Two methods are open to marketing societies. They may either :—(a) Act as agent or salesman, charging a commission on the produce sold to cover expenses, or (b) arrange for the marketing committee to buy the produce itself for resale at a profit.

The second method involves considerable risk. In the first place if the marketing committee are not both experienced buyers and judges of demand they may be left with the goods on their hands. Secondly, to be successful they must maintain the right of rejecting unsuitable produce, and the exercise of this right may offend the members who wish to dispose of their surplus produce, and so kill the marketing scheme at the outset.

It should be realised that, where any business is entered into which involves liabilities on a considerable scale, a *registered society should be formed to deal with it*. An institute or club as such should not undertake it.

A stall may be rented in the market for the disposal of the goods, or more permanent premises may be taken, but care should be exercised that the cost is not too great for the amount of trade expected. Occasionally it is possible to make



an agreement with the auctioneer in the market by which all the produce is sold under the hammer.

**Ways and Means.**—*Committee.*—This can be either the executive committee of the club or institute, or a special marketing sub-committee. A fairly small committee is desirable for this purpose.

*Workers and Wages.*—It will probably not be possible to pay much in wages. Possibly in a good many cases there will be one or more members who will make this their contribution to the institute or club, and will undertake to help voluntarily. In other cases, without paying a definite salary, it may be possible to give a small honorarium to the person who bears the brunt of the work.

*Capital.*—Whether capital to any considerable amount is required must depend entirely on the nature of the business it is proposed to undertake. If it is run on very simple lines comparatively little may be needed, though it may even then be necessary to buy a stand and trestles for a stall, egg boxes, baskets, etc., and to arrange for transport. If this is done, a special fund for the purpose should be raised.

Where business on a large scale is contemplated it will probably be best to register a separate co-operative society and proceed to issue shares (see below).

*Expenses.*—The institute or club will of course aim at returning to members the best price possible for their produce. Zeal for economy must not be carried beyond the limit of sound business, and sufficient margin must be allowed to cover rather more than full working expenses. What the margin should be must depend on local circumstances, but the committee should be most careful to ascertain what are the weekly working expenses and what is the weekly turnover. They can then calculate how much must be deducted from the payments to the members so as to make ends meet and leave something over to place to a reserve fund at the end of the year.

In the case of 12 Women's Institutes with marketing schemes, three charge 2d. in the shilling to cover expenses; seven charge 1d. in the shilling; one charges 2d. on perishable goods and 1d. on non-perishable; and one charges 1d. to members and 2d. to non-members.

It is better to start with sufficient margin and then be able to reduce than to make losses at the start and perhaps wreck the scheme. Eggs can probably be handled more cheaply than more bulky produce.

*Registration.*—The question arises whether voluntary societies which develop into trading bodies should seek registration with limited liability under the Industrial and Provident Societies Act. Registration entails both advantages and obligations. On the one hand the liability of individuals is limited to their shareholding and rests on all the shareholders instead of resting personally with the officials and committee. On the other hand registration involves the issue of shares and the obligation and expense of a public audit.

On the whole it would seem that where marketing is undertaken on a small scale or in a simple form such as that explained under the heading *Methods of Sale (a)* above, registration may be deferred, but that if the business becomes large or where considerable amounts of capital and other responsibilities are involved, the registration of a separate trading society will be desirable. In the latter case the Agricultural Organisation Society will supply rules and assist with the formalities.

*Accounts.*—A simple system of accounts will probably suffice, but it is most important that the accounts be kept accurately and up to date. If possible the advice of a professional accountant should be sought as to the best system. A separate bank account should be opened for the produce department and all money be paid into it.

*Insurance.*—Buildings, stock, motor vehicles, etc., should be insured against fire and accidents. Employer's liability risk should also be covered.

*Eggs.*—In many country districts special interest is attached to egg production. It was suggested above that in the first place effort should be concentrated on supplying the immediate locality rather than sending produce away by rail. Eggs to some extent are an exception. They can more readily and profitably be sent away than most other produce. Even with eggs, however, there is a further consideration. For the greater part of the year new-laid eggs find a ready sale and the eggs on a market stall will often help to sell vegetables and other produce which may be less in demand. It will be advisable, therefore, to send away only surplus eggs which cannot be sold locally.

*Regularity of Supply.*—Irregularity of supplies is the rock on which have foundered many promising schemes for the sale of produce. The quantities of apples, eggs, cheese, etc., which come to us from overseas are shipped to a large extent



by co-operative societies, but in their case it is becoming more and more the custom to bind the grower under an agreement to sell the whole of his produce through his society.

Care must of course be taken that the needs of the village are supplied first, but suppose for argument an institute or club starts a market stall in a country town. People come there to buy and will expect to find regularly what they need. It is no use providing an excess of cabbages one week and none the next, but sending instead an over supply of poultry. In that way very poor prices will be the first result, and complete failure the second. Another serious offence on the part of some producers is to sell their good quality produce themselves and send in the second-rate stuff to the society. That again will soon break up any scheme. The loyal and *continuous* support of the members is essential.

Before starting, therefore, the committee will be well advised to ask themselves these questions:—Is the right kind of produce available? Is it available in sufficient quantities? Is there reasonable certainty that regularity and continuity of supply can be maintained after the market has been started? If the reply to any of these questions is in the negative, the scheme had better be deferred until the position is more satisfactory.

**A Women's Institute Marketing Society: Criccieth, Carnarvon.**—As an example some notes are given below of the start and progress of a marketing society formed by the women's institute at Criccieth.

*Initial Steps.*—This scheme was started in June, 1916, under the direction of the Executive Committee of the Women's Institute. An initial capital of £5 was raised from among the members and, with an additional £5 voted from the general funds of the Institute and the commission on sales, proved sufficient. A market manageress was appointed at 5s. a day, but all other labour, including transport of produce from the depôt to the station, was voluntary. Duplicate receipt books were used and the Committee were responsible for checking the accounts.

The turnover during the first 14 weeks was £245, and the success of the initial venture decided the Committee to turn the Voluntary Co-operative Marketing Scheme into a registered Co-operative Society.

*Further Development.*—In January, 1917, a Co-operative Society was formed, affiliated to the Agricultural Organisation Society, which gave advice on general organisation. The

society was registered under the Industrial and Provident Societies Act and was open to non-members and men. A large section of women's institute members joined the new society; and shares were issued, assessed on an acreage basis—holders of less than half an acre being allowed to take up one share at 2s. 6d., holders of up to 10 acres might take two shares; those with over 25 acres must have eight shares.

A piece of land was now leased from the Cambrian Railway Company and a wooden building erected to serve as a wholesale dépôt. A small shop in the town was rented on a six months' tenancy to serve as the retail dépôt.

The present staff consists of a part-time Secretary at £35 per annum, a Collector at £2 per week, Sales Manageress at £120 per annum, Assistant 10s. per week.

A commission of 10 per cent. is charged by the society to wholesale firms and an additional 25 per cent. is charged when selling retail to the public. Prices are fixed on the basis of local and Liverpool markets. Accounts are checked daily by the Secretary during the busy season and are presented to the Committee once a month. A public audit is made twice a year. Produce is obtained by the society from shareholders only, and includes potatoes, poultry, rabbits, eggs, fruit, vegetables, butter, and similar produce. The venture has done much to stimulate production with regard to poultry and eggs.

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## MAT MAKING.

*Communicated by the Rural Industries Intelligence Bureau,  
258, Westminster Bridge Road, London, S.E.1, where  
reprints can be obtained.*

THE making of woollen rugs by hand on canvas is often advocated as a paying home occupation for elderly persons, invalids, disabled soldiers and others, but it is very seldom that it is found to be so in fact. The chief reasons for the popularity of the idea seem to be that very little and inexpensive equipment is needed, and that the work is easily learnt, and this is true enough; but other equally important points which are often lost sight of are that the expensive materials required and the amount of hand labour involved make these articles much too costly to be at all readily saleable at rates which will pay the maker. Consequently rug making is really more to be recommended as a hobby than as a means of livelihood. (For remarks on rug weaving see p 852.)



When we turn, however, to a consideration of the possibilities of mat making better prospects are at once disclosed. In the first place, much cheaper materials are used, and in the second, the employment of equipment of a comparatively simple and cheap kind enables the rate of working to be greatly increased, so much so that the selling prices of the product can be quite low consistently with a reasonable remuneration to the worker.

Even so, however, mat making of the kind to be described cannot invariably be recommended as a whole-time industry, mainly because the disposal of output depends largely upon retail sales and a comparatively narrow local connection. Large quantities of mats are imported from India and elsewhere for disposal to traders at prices with which the individual would find it difficult to compete. They are made in standard sizes and patterns by cheap native labour. On the other hand, the local worker's principal opportunity for getting orders from the trade will be due to the special demand, by motorists, car dealers, agents, etc., for small quantities of odd sizes and special shapes, which are very much more expensive when obtained through the usual wholesale channels, but can be produced by the small local maker with little or no greater trouble and expense than the standard sizes—and sold at better prices.

At the same time the supply at any rate of small quantities at wholesale rates to retailers in the worker's neighbourhood or nearest town, need by no means be ruled out as an impossibility, and it should be worth while canvassing them for orders as well as trying for retail sales to private houses, shop-keepers, private or public institutions, etc.

There are few articles of more extensive every-day usefulness than the common coir or fibre mat, and the possibilities of local absorption should easily be sufficient to provide an individual with at least a remunerative part-time occupation. For this reason it might be very suitable for the agricultural worker during his slack seasons. In some cases, where it seems likely that the output of a whole-time worker can be disposed of without difficulty or where special contracts can be obtained, an industry of this sort would be alone able to provide a livelihood.

The work is coarse and fairly heavy, and generally rather unsuited for invalids or disabled men, though some operations undoubtedly could be performed by them. It would depend rather on the nature of the disability. The wool and wool bordered mats entail the least physical exertion, and could be made on the loom by women or girls.

**Types of Mats.**—There are several different types of mats which can be made, needing varying kinds of outfit to produce. These will be briefly dealt with in order, with an example and estimate of costs in each case.

The following table should be useful—it gives the dimensions of standard mats according to the numbered sizes. The prices wholesale and retail (as at August, 1923) must be regarded as approximate only. They may vary a good deal, not only in different districts, but also, of course, according to quality and price of the materials used; and the wholesale rates would be subject to discount for cash or monthly accounts.

Standard.		Reversible.		Sinnet.		Good Quality Yarn.		Wool-bordered.	
No.	Size.	Retail.	Wholesale. Per doz.	Retail.	Wholesale. Per doz.	Retail.	Wholesale. Per doz.	Retail.	Wholesale. Per doz.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1.	24 in. × 14 in.	11	8 0	3 3	33 0	2 9	26 0	4 6	46 0
2.	27 in. × 16 in.	1 2	10 0	4 0	42 0	3 3	33 0	5 9	60 0
3.	30 in. × 18 in.	1 4	12 6	5 0	52 0	4 0	40 0	6 9	74 0
4.	33 in. × 20 in.	1 7	15 0	6 0	64 0	4 6	49 0	8 0	89 0
5.	36 in. × 22 in.	1 10	18 0	7 0	77 0	5 6	59 0	9 6	106 0
6.	39 in. × 24 in.	—	—	—	—	—	—	—	—
7.	42 in. × 26 in.	—	—	—	—	—	—	—	—
8.	45 in. × 28 in.	—	—	—	—	—	—	—	—
9.	48 in. × 30 in.	—	—	—	—	—	—	—	—
Outsizes ...		7d.—9d. per sq. ft.		1s. 9d.—2s. per sq. ft.		1s. 7d.—1s. 8d. per sq. ft. (and up to 3s. 6d. or 4s. per sq. ft. if required specially shaped).		2s. 6d. per sq. ft.	

Standard sizes above No. 5 are seldom if ever stocked, and can usually be charged for almost at the rate of “outsizes.” What are called “slips” are stock sizes 12 in. wide by 27 in., 30 in. or 33 in. long.

*Outsizes* are mats made singly or in small quantities to a customer's special requirements, and they will be by far the most profitable kind of order for the small worker. Motor car owners often require a special shape or size to suit the foot boards or the body of their cars, and have to pay fancy prices to dealers in motor accessories for them. The worker should canvass garages near him, and car owners also, both for orders and to advertise the fact that he can supply these special articles. He may often indeed get better prices than those mentioned above for this class of work.



1. **Reversible Mats.**—These are made entirely of coarse fibre spun yarn loosely double stranded, which is sold in several grades of quality at prices from £15-£20 per ton. Assuming that the small worker bought in smaller quantities he might expect to have to pay on an average 20s. per cwt.

For appearance sake, it is usual to dye a border all round the edge, 2 to 3 in. wide in a bright colour. The cost of the dye depends rather on the colour used, but should not exceed 10s. to 12s. per lb. An exceedingly small quantity is required per mat. Half a pound of dye should be sufficient for 16 doz. mats of No. 1 size, or 12 doz. of No. 2 or 10 doz. of No. 3. The outfit required for making consists of a reversible mat-making frame with rod and needle, a narrow dyeing trough of sufficient length to accommodate the longest side of the largest mat intended to be made, and a knife. The total cost of these would be about £9. The operation of making these mats is very simple, and the use of the frame can be learnt in a few hours, although the speed necessary to make the work pay can only be acquired with practice. The dyeing of the border is still easier and can be done by a boy or girl. Sufficient of the dye dissolved in water is placed in the trough and kept hot. Each edge of the mat is then dipped in turn and held in the solution for 10 or 15 seconds. It is usual to dip two mats at a time. Dipping should proceed at the rate of about two mats per minute, and the mats should then be hung over a rope for an hour or two to dry.

The rate of production by an experienced worker should be about 8 to 10 sq. ft. of matting per hour.

*Costs Example.*

1 doz. No. 2 Reversible Mats (1 ft. 4 in. × 2 ft. 3 in.)			
Material—			
18 lb. of yarn at 20s. per cwt. say ...	...	...	s. d. 3 2½
Dye (½ lb. for 12 dozen) ...	...	...	5
Labour—			
Making—4 hours charged at 1s. ...	...	...	4 0
Dyeing at 100-120 per hour at 1s. ...	...	...	1½
Prime cost of 1 dozen mats ...			7 9

It will be seen that both wholesale and retail selling prices leave a good margin of gross profit after the worker has allowed himself 1s. an hour for his labour. This gross profit, however, has to cover overhead charges, possibly including costs of carriage on material and finished goods, time spent in calling on customers or looking for orders, etc.

2. **Sinnet or Skeleton Mats.**—The making of these mats requires but a very simple outfit, but they may not be found

always so readily saleable as other kinds, and the worker must acquire skill and rapidity in the use of the sailmakers' needle and palm.

The equipment required is a stout wooden frame (with iron plates sunk into it), a sewing palm and a few medium-sized sailmakers' needles of various shapes. The plates in the frame have holes in them to take pegs which define the corners of mats of the various sizes (Fig. 1). Total cost £3 to £3 5s.

This simple and cheap apparatus would suffice for the trained or experienced mat maker, able to calculate for himself the correct sizes of the loops, which vary for different sizes of mats. The beginner, however, would probably find this a difficult and complicated process, leading to mistakes and loss of time, and it would be better in this case to use special frames which are obtainable adapted for making one size of mat only. Greater accuracy and speed in working will result, but he will be put to more expense on his outfit in the first instance.

Prices for these special frames are :—

No. 2 size ... ..	£2 0s.	No. 4 size ... ..	£2 10s.
No. 3 „ ... ..	£2 5s.	No. 5 „ ... ..	£2 15s.

So far as standard size mats are concerned, the use of the special frames will make the work quite simple.

Outsizes are seldom required in this type of mat, but when they are they cannot be made on the standard frames sold but pegs must be driven into the floor or table in the proper positions to suit the required size and shape. Outsizes could only be produced by a worker of sufficient skill and experience to work out correct loop sizes for himself.

Sinnet mat frames are not self supporting, but the worker will require a table to lay them on whilst using them.

The mat itself is made from a single length of plaited fibre yarn, the plait being about 1 in. wide by  $\frac{3}{8}$  in. thick for No. 3 mats and above. This can be purchased ready for use at about 50s. per cwt. It is twisted or bent by hand into the open work pattern required, and stitched up where needed with stout pack thread, sewing twine or fibre yarn.

Very little training is wanted to make this simple kind of mat, but a good deal of experience will be found necessary before mats can be produced rapidly and neatly.

The size perhaps most commonly in request would be the No. 3 (30 in. × 18 in.), and an experienced worker should be able to make them at the rate of about 1 an hour.



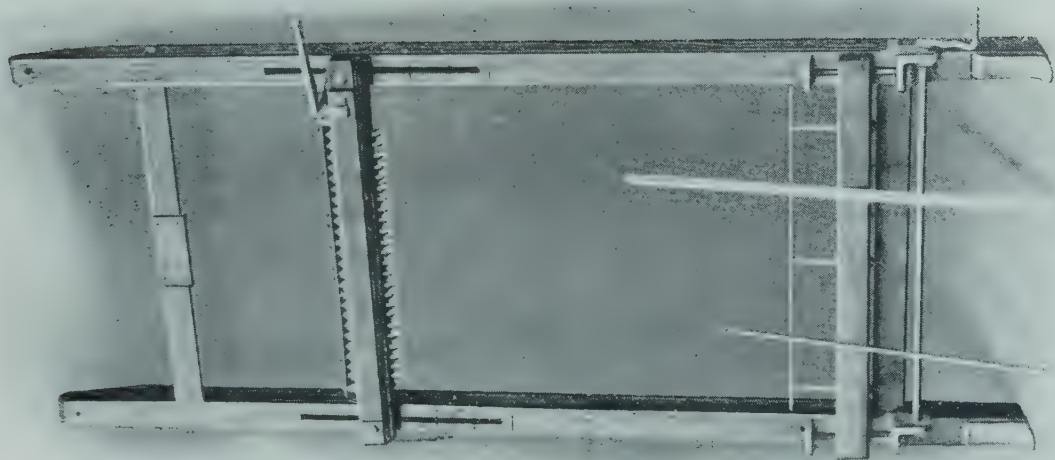


FIG. 1.—A Reversible Mat Frame.

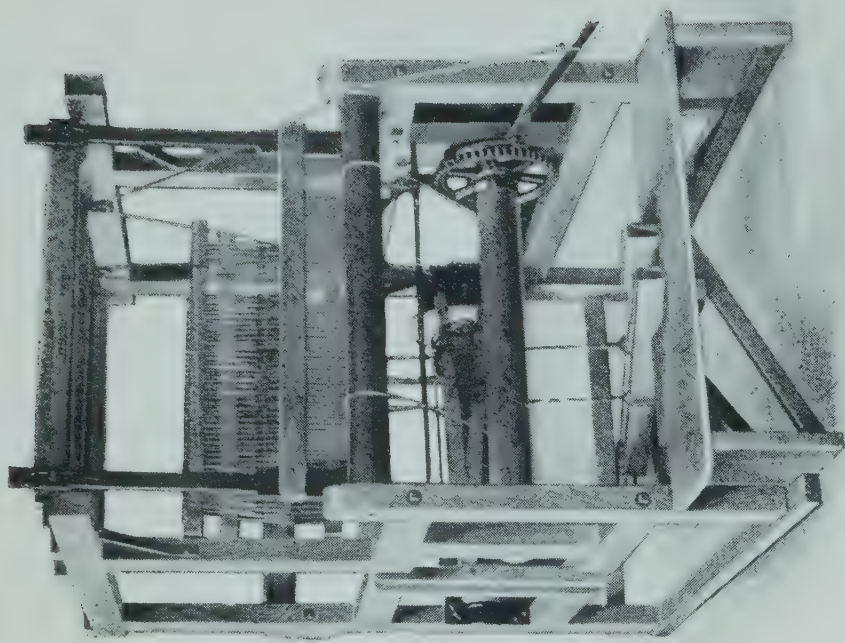


FIG. 2.—Loom for making Coir and Wool Bordered Mats.





*Cost.*—The cost of making 1 dozen No. 3 Sinnet mats is about as follows:—

Material—						£	s.	d.
56 lb. of plait at 50s. per cwt.	...	...	...	...	...	1	5	0
Sewing twine	...	...	...	...	...			3
Labour—								
12 hours at 1s.	...	...	...	...	...		12	0
Prime cost of 1 dozen						£1	17	3

and this size should retail at about 5s. each.

Sinnet mats can also be dyed at the corners or along the edges if desired.

**3. Loom-Made Coir Yarn Mats.**—This type of mat should be the most easily saleable, and is also that most often required in outsizes by car owners and garages. They are made on a hand loom almost exactly similar to the old-fashioned cottage loom formerly used for weaving homespun cloth, but more heavily and stoutly built, mat making being much heavier work than cloth weaving, as the yarn is coarser and the tension of the warp higher.

The equipment required will be the loom with its harness, reed, shuttles or needles (Fig. 2); scissors, shears, cutting-out rod and knife, a simple spool winder, and needle and palm for sewing on the edge binding. The total cost of these would be about £22 to £24.

In addition, if the worker is to beam on his own warp this will require a beaming frame and a raddle at an extra cost of approximately £5. A clear floor space of about 45 ft. by 6 ft. wide will be needed for this operation. This job can of course be done out of doors, but it cannot be undertaken single handed. The worker will in fact require two assistants, one of whom may be a boy, during the operation, which, however, need not be a very frequent one as he should beam on 50 to 100 yards of warp at a time which would be sufficient for 7 or 8 doz. No. 3 size mats. If he is a spare-time worker only this should last for a month or so. The operation would take 3 to 4 hours, including resetting the loom. It is probable that the suppliers of his equipment would do this for him if required, but it will decidedly pay the worker to do it himself if possible.

Space does not admit of describing how the loom is set up for working—the method is almost exactly similar to that described in publications on hand-loom weaving; but after the warp is stretched through the harness and the reed, the way the mat itself is formed is briefly as follows:—

The yarn for the pile which the worker obtains in bales is made up into balls for convenience in working, and two strands of this yarn, taken

together are worked under and over the warp threads, like a kind of coarse spiral spring, the full width of the mat. This is done very rapidly with the fingers and thumb, which must be protected with metal finger stalls from the chafing which would be caused by the very coarse fibre yarn.

The cutting-out rod consists of a long, narrow U-shaped blade of steel. This is slipped inside the loose spiral of yarn, open side upwards, above the warp threads, and the whole is then closed up by a heavy blow with the reed. The worker then inserts the blade of his knife between the two top edges of the cutting-out rod, and passes it rapidly across the whole width. This cuts all the threads at the top of the spiral and forms a double row of pile across the mat. The cutting-out rod is pulled out, another blow given with the reed, and then a couple of threads of the same material woven in to bind the pile. These intermediate or weft threads are put in with the shuttle while alternative threads of the warp are lifted or depressed by the harness, and each is driven tight with the reed. A fresh line of pile is then put in, and so on, till the loom work on the mat is completed.

The sequence of operations described above takes only a few seconds in reality, but the work is more arduous than weaving woollen cloth by hand.

On removal from the loom a length of plait  $\frac{1}{2}$  in. wide, say, is sewn on all round at the base of the pile holding the loose ends of the warp threads in place, and to keep the mat neat and in shape. It will be wise for the inexperienced worker at first to knot alternate loose ends of warp together and with the plait at intervals, or he may find his mats coming to pieces at the ends.

The mat is now ready for the last operation, viz., trimming. The pile as left from the cutting-out operation in the loom will be very uneven, and requires trimming flat with a pair of heavy scissors or shears—the former are best for coir and the latter for wool borders or all-wool mats. The mats should be laid on the worker's bench with one edge overhanging it and trimmed right across at this point, then moved a little further over and the process repeated until the whole is of an even thickness. The mat is prevented from slipping off the bench during this operation by placing a weight on it.

*Cost of Material.*—The approximate cost of the materials used is as follows:—

Coir yarn for pile, ordinary quality, about 28s. per cwt.	
do. do. good quality (motor car work) 33s. to 34s.	
do. for warp and weft ... ..	28s.
$\frac{1}{2}$ -in. plait for binding ... ..	60s.

*Costs Example for 1 dozen mats, size No. 3—*

Material—	£	s.	d.
Yarn for pile, 32 lb. at 33s. per cwt. ...	...	0	9 5
Yarn for warp and weft, 8 lb. at 28s. per cwt. ...	...	0	2 0
Plait $2\frac{1}{2}$ lb. of $\frac{1}{2}$ -in. at 60s. per cwt. ...	...	0	1 4



## Labour—

Proportion of beaming on costs ( $\frac{1}{8}$ say) ...	... 0 1 0
* Balling yarn from bales— $\frac{1}{2}$ hour.	
Making up—14 hours.	
Trimming and binding—6 to 7 hours.	
Say 21 hours at 1s. ...	... 1 1 0
Prime cost of 1 dozen ...	£1 14 9
Each ...	... 0 2 10 $\frac{3}{4}$

This size should retail at 4s. each, or even more for best quality mats.

\* Balling and spool winding can be done by a boy or girl.

4. **Vandyked or Straight Wool Bordered Mats.**—These are made on the loom and with practically the same equipment as in the last case, but the materials are of rather better quality. The type of mat in question has its central portion of coir or coconut fibre as before, but round the edge is a pattern worked in wool of various colours. The warp threads, or rug warp as it is termed, in this case are of a fairly fine linen thread, and it is better in this case to have the beaming on done by the maker of the loom, unless the worker is going in for manufacture on a fairly large scale or on a whole-time basis. A 200-yd. length of warp would be put on at a time, sufficient for about 14 doz. No. 3 mats. To get this done would cost about £3 15s., and would last the spare-time worker some months. The weft yarn is a soft jute cord woven in with the shuttle in the ordinary way, and the wool border is produced by using woollen yarn twisted in, but over a width of a few threads of the warp only on either side of the fibre centre, in exactly the same way as the coir fibre pile was created in the last example describing coir mat making, balls or spools of wool of the colours required being hung at the side of the loom.

These mats are not bound with plait, but at the beginning and the end a short length (about 2 in.) is woven, using a shuttle carrying a rather thinner jute yarn or binding twine. When the mat is removed from the loom these end pieces are doubled over underneath the mat at each end and sewn up.

Trimming of the faces is required as for coir mats. The wool border should be trimmed with the shears to a level below that of the fibre centre portion.

*Cost of Material.*—The wool used is of a much cheaper grade than that usually employed in rug making. Prices vary according to colour from about 1s. to 1s. 1d. up to 1s. 8d. per lb. Black and red are among the cheaper colours. Blues, yellows, greens, etc., are more expensive.

*Cost of Making 1 dozen No. 3 Wool Bordered Mats—*

Materials—				£	s.	d.
Wool, 10 lb. at 1s. 2½d. per lb.	...	...	...	0	12	0
Jute, 15 lb. at 28s. per cwt.	...	...	...	0	3	9
Fibre, 48 lb. at 14s. per cwt.	...	...	...	0	6	0
Binding, 1 lb.	...	...	...	0	0	4
Linen yarn, 3½ lb. at 1s. 8½d. per lb.	...	...	...	0	6	0
Labour—						
* Pulling off wool and teasing fibre—3 hours	...	...	...	0	1	6
Making (45 sq. ft.) 25 hours at 1s.	...	...	...	1	5	0
Trimming—6 hours at 1s.	...	...	...	0	6	0
Prime cost of 1 dozen...				£3	0	7
Each ...				...	0	5 0½

Retail selling price should be 6s. 6d. to 7s.

\* Can be done by a boy or girl.

**All Wool Mats.**—With the same equipment and using the same warp as for the wool-bordered type, by replacing the coir fibre centre portion with a suitably coloured wool—bordered all-wool mats can be made in a great range and variety of patterns and colours. The cost of these would be from 40 to 60 per cent. above that of wool-bordered mats of the same size.

In this style there would be a more frequent demand for special or outsizes—they are often required by car owners to fit in a particular position, or in a shade to match existing upholstery. Another special use besides the ordinary domestic one is seating mats for pews in churches, chapels and other institutions.

**Rug Weaving.**—By using a better quality wool and leaving a thicker pile on the finished article, woollen rugs can also be made on the loom with very much less expenditure of time on labour than is necessary where the common hand methods are employed. While rug making, as mentioned in a previous paragraph, is not often likely to be at all a paying proposition undertaken by itself, it should be quite possible to execute on the loom occasional orders at quite a reasonable price. These rugs will always, however, be fairly expensive owing to cost of material, and consequently sales will be generally too small to provide steady work at them; and it would be unwise, even if possible, to lock up money in accumulating a stock.

**Coconut Matting.**—Coir, or what is often called coconut matting, as well as sacking material for making up into coal bags, sacks, etc., can also be made on the mat loom without any difficulty, but it will seldom, if ever, be possible to compete



in this class of goods with the factory, to say nothing of the products of cheap native labour imported in quantities from India and elsewhere. Individual workers in a small way, therefore, are not advised to attempt it unless they are certain of being able to buy their material at specially favourable rates and to sell their output at an unusually high one.

**Trimming by Machine.**—In describing the process of making coir yarn and woollen mats and rugs above, we have referred to the trimming of the pile to an even thickness as being done by hand with scissors or shears. Shearing machines, either hand or power operated, can, however, be got for this purpose, and one of these would be a very useful addition to the equipment of any worker whose output is at all large; by the use of the shearing machine uniformity of thickness is automatically attained with an immense saving of time and cost of labour.

These machines are rather expensive, a 30-in. hand-operated shearer costing between £70 and £80, but it should pay the worker to instal one, if he finds he can dispose of a whole-time output. Possibly in some cases, two or three workers in the same district might be able to share one, or pay for the permission to use it, if it was the property of one of them only.

**Training.**—For the majority of the operations described in these notes, little training is necessary beyond some instruction in the handling of the equipment or the loom—the necessary skill would follow with experience in working. One firm of manufacturers of mat-making equipment has informed us that they would be prepared to give this necessary instruction at their works to purchasers of their apparatus.

The Bureau will be glad to answer inquiries arising from these notes, and to furnish on request particulars of manufacturers and suppliers of the equipment and materials described.

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## THE LONDON POULTRY MARKETS.

C. A. FLATT.

*Ministry of Agriculture and Fisheries.*

PROBABLY in no other market in the United Kingdom can so fine a collection of poultry be seen as the displays in the London markets of Smithfield and Leadenhall at Christmas time. These markets receive a large proportion of the turkeys and ducks from East Anglia, geese from the fen country and fowls from the fattening districts of Sussex. Although poultry of

good quality come to these markets from all parts, production and marketing has reached a higher standard, and is to some extent better organised, in the areas particularly mentioned.

This not only applies to the Christmas festival, but at all seasons of the year English poultry of the finest quality is to be found in the London markets. There is, however, a large quantity of English produce of inferior grade sent to London, and it has to compete with foreign supplies.

Poultry of all classes is imported to Great Britain from the Dominions and from foreign countries, and a large proportion of it comes to the London markets. Much of it is of very fine quality, and is produced to meet a definite demand and to arrive at favourable seasons.

**Christmas Markets.**—Some indication of the importance of our markets to the foreign producer can be gained from the following figures, which show the arrivals of British and foreign poultry and game into Smithfield Market during the month of December for the year 1922, with comparisons in the years 1921 and 1913.

	1913.	1921.	1922.
<i>British and Irish</i> ...	1,579 tons.	2,089 tons.	1,762 tons.
<i>Foreign</i> ... ..	1,302 „	553 „	1,317 „

It will be seen from these figures that the foreign producer has regained the position he held on this market before the War so far as quantity is concerned, and the figures give some idea of our Christmas bill for foreign poultry.

For the Christmas trade, turkeys, which arrive from France in considerable quantity, compare very favourably with the Norfolk turkeys, geese from Normandy and Holland are of exceptionally fine quality, while fowls from these countries also stand well in the markets. In addition, large numbers of turkeys of a lower grade come from southern Europe.

Ireland, which is included in the return with the British supplies, also sends large consignments of poultry of all classes, and a long study of the market requirements has led to great improvement in the quality and method of marketing of Irish produce.

**Smithfield Market Returns.**—Some further figures from the Smithfield Market Returns are given below to illustrate the steady growth of foreign competition. In these Returns the figures for British and Irish produce are not given separately, and game is included with poultry, but suitable deductions can be drawn.



	1913.	1921.	1922.
<i>British and Irish</i> ...	8,526 tons.	11,711 tons.	12,060 tons.
<i>Foreign</i> ... ..	5,230 „	1,936 „	4,393 „

Here again the recovery of the foreign supplies is notable, but in the figures for the first nine months of the present year, the increase is still further apparent. The figures for the same period of 1922 are given for comparison.

	1922. (1st nine months.)	1923. (1st nine months.)	Difference.
<i>British and Irish</i> ...	7,556 tons.	6,733 tons.	— 823 tons.
<i>Foreign</i> ... ..	2,769 „	3,695 „	+ 926 „

This increase of 926 tons in foreign consignments for the first nine months of 1923 is notable, especially in conjunction with the fact that, of the total of 4,393 tons imported in 1922, 1,317 tons were received in the month of December alone. It is also significant that this increase has mainly taken place in supplies from “Holland and other countries,” whose imports have increased by 849 tons. North America shows an increase of 96 tons, and South America of 17 tons, whilst Australasian supplies have decreased by 36 tons.

There is, on the other hand, a decrease in the same period of supplies of British and Irish birds. This decrease in the nine months outweighs the gain in the 12 months of 1922 over the 1921 supplies.

**Market Requirements.**—Reference has already been made to the supplies for the Christmas markets. Of the poultry received at other seasons, the American box chickens of about 3 lb. weight are well favoured on the market, and French poultry meets a ready demand. A new feature on the market this year were Belgian fattened fowls almost comparable with “Surrey” fowls. They arrived late in the season, but realised within a few pence per lb. of the price paid for the latter.

The demand for poultry varies to some extent at different seasons (*see* Leaflet No. 201), but there is plenty of evidence to show that special demands can be created for any class of produce if this is of good quality. It is doubtless the poultry-keeper's first business to study the normal demands of the market and to endeavour to supply these, but if for other reasons the class of poultry produced is not such as to meet the normal requirements, there is every reason to suppose that if this particular product is put on to the market in the best possible manner, a good trade will be found.

Complaint is sometimes made of the returns received by producers for poultry sent to London salesmen. These can be accounted for in various ways.

A large quantity of the poultry received in the markets is badly finished, birds being ill fed, badly prepared and carelessly packed. Consignments are also irregular and frequently sent without sufficient warning to the salesmen.

It is probably a fact with poultry, as it is said to be with other goods, that London will absorb any class of product, but the producer of inferior quality poultry will seldom gain by sending long distances to this market. On the other hand, birds of good quality are frequently spoilt by ignorance in their preparation and in packing. In the first case the inferior birds will probably sell equally well in live condition at a local market, and in many cases these birds will be brought into better condition by the purchaser before they are eventually killed. If the producer intends to market the birds dead, he should first bring them into fit condition. Care in the details of marketing is very important; appearance adds much to the value of the product, and uniformity in the quality of the birds in a consignment is very desirable.

Where regular consignments are sent to a salesman, he is in a position to find a steady outlet for these at a satisfactory price, and in dealing with regular and large quantities of good quality produce the London markets seldom fail. Even when small consignments can only be sent at irregular intervals, if these are of good quality and the salesman is notified to expect them at a given date, satisfactory results follow. In supplying a large market like Smithfield, however, some knowledge and organisation is required. The exporter of foreign produce studies his market carefully, and directs his supplies accordingly. These supplies are also sent in larger consignments, and are consequently handled by the salesman with more economy in labour.

To effect similar results with English poultry, organisation is badly needed. In some areas the organisation has grown: the fatteners of poultry in the Heathfield and Uckfield districts and the duck fatteners in Norfolk, for instance, can be sure of their produce meeting a ready sale in the London markets. If English producers of poultry in other areas are to meet the increasing competition from abroad upon more equal terms, especially in this important market, it can only be done by a study of market requirements with a view to the adoption of better methods by the producer, and by some organisation for the regulation of supplies.



## THE IMPERIAL FRUIT SHOW, 1923.

J. TURNBULL and A. WHITING,  
*Ministry of Agriculture and Fisheries.*

THE third Imperial Fruit Show which was held at Manchester differed considerably from all previous fruit shows. In the first place it has been wholly organised and financed by the fruit industry itself. That fact augurs well not only for future fruit shows, but for the whole future of the industry. It completely refutes the too commonly expressed view that it was impossible to combine such completely opposing interests as those of the different sections of the fruit industry.

The two primary objects of the show, viz., to improve the presentation of apples by better grading and packing, and to stimulate the demand for apples by the consumer—have been notably advanced. The idea of having with each exhibit an extra package to be shot out for the purpose of judging, left the remainder of the exhibit undisturbed—adding to the general attractiveness of the display and further demonstrating good and poor methods of packing. It also provided exhibition fruit for retail sale. Visitors were able to taste apples at the stand of the Federation of British Growers and then pass on to the retail stand to purchase apples. So popular was this feature that the exhibition fruit was cleared out quite early during the show. It is the most effective move that has yet been made in stimulating the demand, and should play an important part in the organisation of future fruit shows. Arrangements might even be made whereby the public could purchase whole exhibits if the latter were priced by a valuing committee. The improvement in the general level of packing is very marked. The adoption of a standard method of box packing has greatly reduced the difficulties of newcomers in arriving at a suitable pack for different varieties and sizes. In the past, the Kent section has been well in advance of the East and the West, but now there is little to choose between the different sections. There are now more growers able to put up a sound commercial pack, with the consequence that few exhibits fall short of the exhibition standard. The display of the judges' score card in each class again attracted the lively interest of the growers attending the show. The display of cards showing the merits and uses of each variety was a useful innovation, and added materially to the propagandist value of the show. The shortness of the crop

resulted in a decrease in the number of entries, but quality was well maintained notwithstanding that the growing season was remarkable for the severity of the attacks of insect and fungus pests.

Section.	Numbers in 1922.		Numbers in 1923.	
	Exhibitors.	Entries.	Exhibitors.	Entries.
British Empire—				
United Kingdom ... ..	24	39	14	34
Canada ... ..	9	17	4	5
Australia ... ..	5	6	3	3
South Africa ... ..	7	9	—	—
Overseas ... ..	13	92	6	28
Kent and Southern ... ..	47	222	17	89
East and Northern ... ..	43	187	38	109
West and Midlands ... ..	29	128	17	76
Irish ... ..	44	71	9	11
Channel Islands ... ..	58	85	7	8
United Kingdom* ... ..	30	58	10	19

\* In addition to other classes included above.

**Apples.**—*British Empire Section.*—Contrary to last year's experience, the best exhibits in the show were to be found in this section. This is as it should be and was no doubt in some measure due to the reduction from 20 to 10 in the number of packages required. The most striking feature of the section was the very high level attained by the great majority of the exhibits. In most cases the apples were almost perfect specimens and their condition showed that the greatest attention had been paid to every detail of picking, storing, grading and packing. It is obvious that if these details maintain such a high standard at future shows competition will be so keen that one blemished specimen may be the deciding factor in making an award. The judges had the greatest difficulty in differentiating and attention had to be directed to quite minor points of detail, such as trueness to type, before a decision in some cases could be reached.

In the dessert class, there is always keen competition between Cox's Orange Pippin and McIntosh Red. In this country we hold the view that the flavour and texture of good Cox's Orange Pippins are unapproached, but the Canadians maintain that McIntosh Red holds the premier position in this respect. No one could doubt, however, that the exhibit of McIntosh Red from British Columbia deserved first place. This was a collective exhibit from an Association of Growers who naturally had more opportunity to obtain a perfect selection of fruit. There was not a single blemished apple in the turned out package, and it is



doubtful whether more perfect quality and finish for this variety could be obtained. Possibly the pack might have been considered a shade low at the ends and not absolutely solid. The second prize went to Cox's Orange Pippin from Malvern. Against the McIntosh Red these looked a little dull and russety, with some blemishes round the stalk end. Grand specimens as they were, the finding of several fruits with slight cracking near the stalks was sufficient alone to reduce the points awarded under "condition." The size (188) was about right for the variety and gives a solid pack standing up well under show conditions. If any criticism could be made, it would be that the pack looked a little flat. The third position was reached by McIntosh Red from Quebec. These were not so bright as the winning exhibit, being a little bruised and the pack rather slack. The fourth place went to Allington Pippins, also from Malvern, typical of the best of this variety, and of fine size (175); the pack was perhaps a little flat-looking as was the case with the Cox's Orange sent by this exhibitor. The fifth place was also given to Allington Pippins, this time from East Suffolk. They were well coloured, but the skin quality was not quite up to the last named. An exhibit of Worcester Pearmain, which was almost perfect, well coloured and packed, lost on condition and flavour quality. It would appear that this variety cannot hold its own in such a competition at a date so late in the year. A good exhibit of Cox's Orange Pippin put up by the Essex Growers' Branch of the Federation of British Growers won the Gilroy Challenge Cup.

In the culinary class the premier award was gained by an exhibit of Blenheim Orange from Warwickshire. These were an almost perfect sample of this variety, well packed and 96 to the box. The second place was secured by Lane's Prince Albert, sizes 80 and 88, from Malvern. They were not quite uniform in condition and quality, and the pack was a little uneven, but freedom from any form of blemish or bruise was very noteworthy. The third position was awarded to an exhibit of Lord Derby from Kent—a very good sample of the variety, but not quite up to size (88 to the box). They showed a little hail damage and the pack was rather flat in some boxes. The fourth lot were of the variety Wagener, from British Columbia. They were on the small side for a cooking apple—size 113—appeared to have been badly picked, and the pack was rather slack in three boxes. The condition and skin quality, however, were again typical of perfect selection by the British Columbia

Growers. The fifth, Charles Ross (88 and 96 to the box), were not uniform in size, shape or quality, and the pack was a little uneven. Very fine Newton Wonders from Malvern secured high points for packing, but lost points on condition and quality on account of bitter pit. Very fine Bramley Seedling from East Suffolk showed slight bitter pit and were rather slack in the pack (88 to the box). Bismarcks from Essex also showed a little bitter pit and the tight pack had bruised some apples against the ends of the box. There was evidence here of slight jamming in of the unwrapped layer.

*United Kingdom Section.—Cox's Orange Pippin.*—The first prize in the box class went to Herefordshire for well packed Cox's of outstanding colour and quality. The second, from Essex, were not quite such a typical colour and the pack also not quite so good—size 188. The third, from Berkshire, were of fine finish and colour, but the pack was rather slack and low. The first prize in the half-sieve class went to Devonshire for an exhibit of fine colour, finish and skin quality, a good size, uniform and well packed. These were probably the best conditioned Cox's in the show, and realised at auction 36s. per half-sieve. The second from Herefordshire were well packed and of an attractive appearance, but they were in soft condition and not uniform.

*Worcester Pearmain.*—The first prize lot came from Norfolk and were almost perfect in every way, receiving 95 per cent. of marks, size 188. The second from Kent were also very fine, size 175. The wrapping paper showed "tails" in the spaces. The third from Evesham were below the others in colour and condition, but were very well packed. In the class for Any Other Variety (except Cox's Orange) in half-sieves, Worcesters were awarded second and third places, being beaten only by an outstanding example of King of the Pippins.

*Allington Pippin.*—The first prize went to Herefordshire. Allington's of exceptional colour though rather small (216). The second, from Kent, were fine specimens, but too many sizes, most of which should have been packed 3-2. The third, from Kent, were well packed, bright fruit but rough skinned. The exhibits from the Eastern Counties were unfortunate in not being "placed" in this class as some had nearly full points for colour, finish and condition, and the pack was good. The majority also were more typical of the variety than more highly coloured fruit from Herefordshire.



*Blenheim Orange*.—The first prize for dessert Blenheims in boxes went to Kent for a sample of bright colour and good condition very solidly packed. The size (112 packed 2-2) is rather large for dessert, but a smaller size means a 3-2 pack with wide spaces, which is apt to shift under show conditions when the top layer must not be wrapped. The second, from Evesham, were not so bright and level in colour and the apples were not uniform in size.

*Any Other Variety*.—*Dessert*.—In boxes the first prize was won by a Herefordshire exhibit of King of the Pippins, outstanding in everything except condition. These were followed by very good Gascoyne's Scarlet from Essex, which made the same price, viz., 20s. per box, and for third place by King of the Pippins from Worcestershire. In half-sieves this class included all varieties except Cox's, and the first prize again went to Herefordshire. King of the Pippins much like the first, mentioned above.

(To be concluded.)

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## NOTES ON MANURES FOR DECEMBER.

H. V. GARNER, B.A.,

*Rothamsted Experimental Station.*

**Signs of Starvation**.—The yellowish appearance of plants which are suffering from a shortage of available nitrogen, as for example in the case of winter-sown cereals in a wet cold spring, is well known. It is perhaps not so generally recognised that deficiency of potash also produces marked symptoms in such potash-loving crops as mangolds and potatoes. On Barn Field, at Rothamsted, where mangolds have been grown without potash on certain plots for many years, their appearance this year has been far from normal. The leaves became wrinkled, flabby, of a very dark green colour and tended to wither at the margins, while the leaf-stalks were much yellower than is normally the case, and the whole plant was stunted. Potatoes grown without potash showed rather similar effects. The growth was poor, the leaves were dark blue-green and dying-off was premature. Needless to say, the yield of tubers has been seriously reduced. The above effects are only seen

in extreme cases, but complete omission of potash manures for a single season will often produce them in the case of potatoes.

**Top-Dressing the Nurse Crop.**—In a recent experiment at Rothamsted, barley undersown with red clover had been top-dressed at a time when the young seeds were just appearing through the ground. The dressings per acre were :—

- (1) Superphosphate 2 cwt.
- (2) Superphosphate 2 cwt. + Sulphate of Ammonia 1 cwt.
- (3) Superphosphate 2 cwt. + Sulphate of Ammonia 2 cwt.

These dressings produced their usual effect on the barley crop. Superphosphate alone had little effect on the crop, which was not visibly different from barley without manure, but each addition of sulphate of ammonia gave a marked increase of grain and straw. On examining the clover plant after the barley had been removed it was noted that the dressing of superphosphate had resulted in a very good plant of seeds; the addition of 1 cwt. of sulphate of ammonia had very slightly damaged the plant, while the double dressing had been distinctly destructive. It would seem advisable in similar cases to limit the nitrogen as dressing to about 1 cwt. per acre and apply it at barley sowing. Where mixed grasses and clovers are sown the effect would not be so marked, as any loss of clover would be compensated in part by the increased growth of grass obtained from the sulphate of ammonia.

In another experiment on the influence of manuring on the malting quality of barley, one plot of barley had the sulphate of potash omitted from the complete artificial mixture while all the others received potash. The effect of the omission was not so marked in the barley crop, but the clover under the barley showed a striking depression below the level of the remaining plots which had received potash. The above effects serve to bring out the importance of considering manuring in relation to a sequence of crops rather than to the one which will actually receive the application.

**Storage of Fertilisers.**—Prices of artificial manures tend to vary with the season of the year, being slightly higher when they are wanted for immediate application than at other times. Quick-acting fertilisers are in most demand in March, April and May, while basic slags are more taken up in the autumn and winter months. A manure shed on the farm enables the farmer to take advantage of these small differences by buying in his supplies at a favourable price and storing them under



good conditions until required. He is also independent of possible delays in delivery in the busy seasons. Dryness is the essential for a manure shed. A concrete floor for mixing purposes and wooden bins to hold the fertilisers in bulk or in bags are desirable. Most of the common fertilisers can be kept indefinitely in a dry shed without chemical changes taking place. A certain amount of atmospheric moisture may be taken up and cause lumps to be formed, but these are easily dealt with on the floor either with a wooden rammer or the back of a shovel.

Dry neutral sulphate of ammonia keeps in better condition than the ordinary grade and does not rot the bags. Lime cannot be stored in bags for any length of time. Casks of nitrate of lime should only be opened as required, as any unused excess tends to become moist when exposed to the air.

**Grass Land.**—The manurial requirements of pasture and meadow land may be regarded in the light of the losses of fertilising constituents which each type of grass land suffers in the ordinary course of farming. A few approximate figures are given of the losses sustained by one acre of grass land in its period of maximum productivity during the five months of summer grazing or the growing season of the first hay crop as the case may be. The losses of nitrogen, phosphate and potash are calculated as nitrate of soda, 30 per cent. superphosphate, and 12 per cent. kainit respectively.

Type of grass land.	Produce removed per acre.	Taken from the land.		
		Nitrogen as Nitrate of Soda.	Phosphate as 30% Super.	Potash as Kainit.
Fattening pasture stocked with full-grown beasts.	250 lb. fattening increase.	lb. 19	lb. 10	lb. 1
Medium store land stocked with yearling stores.	200 lb. live weight increase.	37	26	3
Medium hay land.	20 cwt. hay.	205	59	282

It will be seen that the mature animals make little demand on the fertilising constituents of the pasture. The nitrogen removed would be amply provided for by the cake feeding which is commonly received at some period of the year. An application of basic slag, superphosphate or bone meal every four years would maintain the phosphate and tend to balance the added nitrogen of the cake. Potash manures would not commonly be required on such land.

Grazing with stores takes more out of the land. A phosphatic dressing (5 cwt. per acre of 40 per cent. basic slag or its equivalent) applied every 4 or 5 years will generally provide the necessary phosphate and also the nitrogen by the agency of the clover which usually appears after phosphates are applied to stiff land. If slag appears to have little effect the land may be sour (in which case the only remedy is an application of some form of chalk or lime), or potash may be deficient, when a dressing of 4 cwt. per acre of kainit in addition to the slag will often give satisfactory results.

The hay crop is exhaustive of all constituents, particularly of potash and of nitrogen, and complete and fairly generous treatment is required to maintain permanent meadow land. If dung can be spared it may be used at the rate of about 10 tons per acre every 4 years. In each intervening year a complete artificial mixture can be given consisting of 2 cwt. of superphosphate and 3 cwt. of kainit per acre in autumn, and 1 cwt. per acre of nitrate of soda, sulphate of ammonia, or nitrate of lime in spring. The above, with residues of foods fed on the aftermath, should keep up production. If the land tends to become sour, an autumn dressing of 10-15 cwt. per acre of ground lime or its equivalent (1-1½ ton) of ground limestone may be applied every 3 or 4 years, and in the year of liming the artificial mixture could be omitted.

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## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending November 7th.				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ...	...	13.15	13.10	13. 2	16.11
" " Lime (N. 13 per cent.) ...	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.12*	13.12*	13.12*	13.12*	(N)13. 1
" " " neutral (A. 25¾ per cent.)	14.15*	14.15*	14.15*	14.15*	(N)13.11
Kainit (Pot. 12½ per cent.) ...	...	...	...	2. 5	3. 7
" (Pot. 14 per cent.) ...	2. 7	1.18	2.10	2. 7	3. 5
Sylvinit (Pot. 20 per cent.) ...	...	...	...	2.10	2. 6
Potash Salts (Pot. 30 per cent.) ...	...	...	...	3.10	2. 4
" " (Pot. 20 per cent.) ...	...	...	...	2. 5	2. 3
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 0	7. 0	7. 0	2.10
Sulphate of Potash (Pot. 48 per cent.) ...	13.10	...	10.10	10.15	4. 6
Basic Slag (T.P. 35 per cent.) ...	...	...	...	3.10§	2. 0
" " (T.P. 30 per cent.) ...	...	...	...	2.17§	1.11
" " (T.P. 26 per cent.) ...	2.13§	2. 5§	...	...	...
" " (T.P. 24 per cent.) ...	2. 9§	2. 1§	2. 0§	...	...
" " (T.P. 20-22 per cent.) ...	...	1.18§	...	2. 5§	2. 3
" " (T.P. 18 per cent.) ...	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.13	...	3. 7§	3. 5	1.10
" (S.P. 30 per cent.) ...	3. 6	3. 0	3. 0§	3. 0	2. 0
Bone Meal (A. 4½. T.P. 45 per cent.) ...	9.10	8.10	9. 0	8.10	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.) ...	6. 5	6.10†	6. 0	6. 5	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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## MONTHLY NOTES ON FEEDING STUFFS.

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**Soybean Cake and Soybean Meal as a Feeding Stuff.**—Soybean cake and soybean meal are two useful feeding stuffs which do not appear to be as widely used in feeding practice as their feeding value merits. Both the cake and the meal are derived from the soybean (*Glycine hispida*), being the residue left after extraction of the oil by pressing and extraction by solvents respectively. The soybean is a leguminous seed, and is chiefly

cultivated in China and Japan, where it is used in many different ways as human food. Its chief characteristic is its high oil and protein content and easy digestibility. Average analyses, nutritive ratio and starch equivalent are as follows:—

		Moisture.	Protein.	Oil.	Carbohydrates. Soluble.	Fibre.	Ash.	Nutritive Ratio.	Starch Equiv.
Soybean	...	10.0	33.2	17.5	30.5	4.1	4.7	1:2	78.9
Soybean cake	...	14.5	42.4	7.0	25.8	5.0	5.3	1:1	69.1
Soybean meal	...	11.3	44.7	1.5	31.9	5.1	5.5	1:1	64.0

The above analyses, taken from the Ministry's Miscellaneous Publication No. 32, **RATIONS FOR LIVE STOCK**, enable a comparison to be made between the relative values of the bean, the cake and the meal. It will be seen that both the cake and the meal are very rich in protein, and are useful therefore as a supplement to cereal foods or any other starchy food materials. The protein, oil, and carbohydrates are very digestible, even with pigs the protein is 94 per cent. digestible, the carbohydrates are 92.4 per cent. digestible, and the woody fibre is also 60.5 per cent. digestible.

*Value as a Feeding Stuff.*—It would appear from the foregoing paragraphs that soybean meal and cake should prove useful feeding stuffs. Practical feeding trials bear this out. Feeding trials with the cake and meal were carried out at various agricultural institutions in Great Britain during the years 1909-1911. These trials were carried out with bullocks and dairy cows, and the soybean cake or the meal was tested against decorticated cotton cake or linseed cake. The results of such trials led to the following conclusions:—

(1) At the Midland Agricultural College feeding trials with dairy cows in 1911 showed that soybean meal was equivalent to linseed cake for dairy cows, and gave a better quality milk judged on the fat and butter tests.

(2) At the Edinburgh and East of Scotland College, feeding trials with bullocks showed that soybean cake was a healthy cattle food, and a satisfactory beef producer, and could be used with safety up to 5 lb. per head per day. Weight for weight, it was not quite equal to linseed cake as a meat producer.

(3) Dairy trials at Offerton, under the Durham County Council, showed soybean cake to be an effective substitute for decorticated cotton cake. Owing to its rich protein character it should not exceed 6 lb. per head per day.

(4) Danish experiments have shown that soybean cake and meal give a firm butter, and are quite useful for inclusion in



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.					
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British - -	—	—	9/7	9 12	0 15	8 17	71·6	2/6	1·34
Barley, British Feeding	—	—	8/6	8 10	0 12	7 18	71	2/3	1·20
"    Canadian No. 4	30/-	400	8/5	8 8	0 12	7 16	71	2/2	1·16
Western	30/6	400	8/6	8 10†	0 12	7 18	71	2/3	1·20
"    Danubian-	—	—	9/10	9 17	0 13	9 4	59·5	3/1	1·65
Oats, English, White -	—	—	—	—	—	—	—	—	—
"    "    Black and	—	—	8/9	8 15	0 13	8 2	59·5	2 9	1·47
"    Grey - - -	—	—	10/-	10 0	0 13	9 7	59·5	3/2	1·70
"    Scotch, White -	—	—	—	—	—	—	—	—	—
"    Canadian No. 2	29/3	320	10/3	10 5	0 13	9 12	59·5	3/3	1·74
Western	28/-	"	9/10	9 17	0 13	9 4	59·5	3/1	1·65
"    No. 3 " "	27/6	"	9/7	9 12	0 13	8 19	59·5	3/-	1·61
"    Feed - - -	24/9	"	8/8	8 13†	0 13	8 0	59·5	2 8	1·43
"    American - -	23/9	"	8/4	8 7	0 13	7 14	59·5	2/7	1·38
"    Argentine - -	38/-	480	8/10	8 17	0 13	8 4	81	2/-	1·07
Maize, Argentine - -	36/9	"	8/7	8 12	0 13	7 19	81	2/-	1·07
"    South African	—	—	7/10	7 17†	1 12	6 5	67	1/10	0·98
Beans, Rangoon - - -	—	—	14/6	14 10	1 8	13 2	69	3/10	2·05
Peas, English, Maple -	—	—	25/6	25 10†	1 3	24 2	69	7/-	3·75
"    Japanese - - -	—	—	—	—	—	—	—	—	—
Millers' Offals:—	—	—	—	—	—	—	—	—	—
Bran, British - -	—	—	—	7 0	1 6	5 14	45	2/6	1·34
"    Broad - - -	—	—	—	8 0	1 6	6 14	45	3/-	1·61
Middlings, Coarse	—	—	—	—	—	—	—	—	—
British - - -	—	—	—	8 12	1 2	7 10	64	2/4	1·25
Pollards, Imported -	—	—	—	6 10	1 7	5 3	60	—	—
Meal, Barley - - -	—	—	—	10 2	0 12	9 10	71	2/8	1·43
"    Maize - - -	—	—	—	10 15	0 13	10 2	81	2/6	1·34
"    "    Germ - - -	—	—	—	9 10	0 19	8 11	85·3	2/-	1·07
"    Gluten-feed - -	—	—	—	8 10	1 7	7 3	75·6	1/11	1·03
"    Locust Bean - -	—	—	—	8 0	0 9	7 11	71·4	2/1	1·12
"    Bean - - -	—	—	—	12 5	1 12	10 13	67	3/2	1·70
"    Fish - - -	—	—	—	18 0	4 6	13 14	53	5/2	2·77
Linseed - - -	—	—	—	21 17	1 11	20 6	119	3/5	1·83
"    Cake, English	9/-	—	—	12 2	1 18	10 4	74	2/9	1·47
Cottonseed Cake, English	5½/-	—	—	7 10	1 14	5 16	42	2/9	1·47
"    "    Egyptian	5½/-	—	—	7 7	1 14	5 13	42	2/8	1·43
Decorticated Cotton	—	—	—	—	—	—	—	—	—
Seed Meal 7/- - -	—	—	—	12 15†	2 14	10 1	71	2/10	1·52
Coconut Cake 6% - - -	—	—	—	8 12	1 10	7 2	73	1/11	1·03
Palm Kernel Cake 6% -	—	—	—	6 2†	1 3	4 19	75	1/4	0·71
"    "    Meal 2% - -	—	—	—	5 5	1 4	4 1	71·3	1·2	0·62
Feeding Treacle - - -	—	—	—	6 15	0 8	6 7	51	2/6	1·34
Brewers' Grains:—	—	—	—	—	—	—	—	—	—
Dried Ale - - -	—	—	—	7 5	1 4	6 1	49	2/6	1·34
"    Porter - - -	—	—	—	6 15	1 4	5 11	49	2/3	1·20
Wet Ale - - -	—	—	—	1 10	0 9	1 1	15	1/5	0·76
"    Porter - - -	—	—	—	1 7	0 9	0 18	15	1/2	1·62
Malt Culms - - -	—	—	—	7 10†	1 14	5 16	43	2/8	1·43
Soybean Cake 6% Oil -	—	—	—	10 15	2 13	8 2	69	2/4	1·25

At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of October and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s. per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s.; P<sub>2</sub>O<sub>5</sub>, 4s.; K<sub>2</sub>O, 2s. 4d.

rations known to give a soft butter. German experiments have also shown that soybean meal is quite a useful stuff for feeding pigs. Nils Hansson, in experimenting with soybean cake, found that the use of more than 2 lb. of the cake per head caused taint to appear in the butter. French experience showed that the fresh, non-pasteurised milk from cows given soybean cake was quite sound and wholesome, but a taste resembling that of green peas developed after the milk had been kept some time. This taint was traced to the development of micro-organisms, which, however, were killed by pasteurisation, and the tainting of butter referred to by Nils Hansson was doubtless due to the same cause. Unless therefore milk is pasteurised before distribution, it is not desirable that more than 2 lb. of soybean cake per head per day should be given to the cows. Cases of poisoning from soybean meal have also occurred in this country, but investigation of the cases showed that the poisoning was not due to the soybean meal itself but to the solvent that was used for the extraction of the oil.

*General Conclusions.*—Soybean cake and meal are useful feeding stuffs, are readily eaten by cattle and are useful for all classes of stock. They can be used as a substitute, weight for weight, for decorticated cotton cake in all rations in which this material is included. Owing to the laxative property of the oil contained in the cake, it can safely be used as a linseed cake substitute where linseed cake is being employed for its laxative properties.

The meal or cake can be usefully included in all lamb foods, sheep foods, pig meals and cattle cake mixtures. Milch cows may be given up to 3 lb. per head per day; fattening cattle 4 lb.; horses 3 lb.; fattening sheep and pigs 1 lb.

#### FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s.	£ s.	£ s.		s. d.	d.
Wheat - - - - -	7 18	0 15	7 3	71·6	2 0	1·07
Oats - - - - -	6 12	0 13	5 19	59·5	2 0	1·07
Barley - - - - -	7 14	0 12	7 2	71·0	2 0	1·07
Potatoes - - - - -	1 19	0 3	1 16	18·0	2 0	1·07
Swedes - - - - -	0 16	0 2	0 14	7·0	2 0	1·07
Mangolds - - - - -	0 15	0 3	0 12	6·0	2 0	1·07
Good Meadow Hay - - -	4 10	0 13	3 17	31·0	2 6	1·34
Good Oat Straw - - -	2 9	0 7	2 2	17·0	2 6	1·34
Good Clover Hay - - -	5 0	1 0·	4 0	32·0	2 6	1·34
Vetch and Oat Silage - -	1 18	0 7	1 11	14·0	2 3	1·20

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I. *Wages*.—Generally speaking, few changes were made in the rates of wages agreed upon at the last Whitsun Hirings of farm workers in Scotland.

**Farm Wages and Hours in Scotland.\*** The average earnings of a married ploughman which in 1914 were about 22s. per week, now stand at 39s., i.e., an increase of approximately 77 per cent., which compares favourably with the general increase in the cost of living.

The following table shows the course of wages and earnings in certain areas over the pre-war and highest levels (summer, 1921) up to the present time:—

Area.	Average Weekly Earnings.					
	Summer, 1914.		Summer, 1921.		Summer, 1923.	
	Cash.	Allowances.	Cash.	Allowances.	Cash.	Allowances.
Lower Clyde Valley and North Ayr ...	20/-	4/-	52/-	5/-	32/-	4/-
Fife, South Forfar and Perth Lowlands	18/-	6/-	46/-	14/-	27/-	10/-
South Eastern Counties ... ..	19/-	3/-	— 52/-	—	34/-	3/6
North Eastern Counties ... ..	—	—	—	—	25/-	11/-
West Highlands ... ..	—	—	—	—	18/-	13/-

Allowances consist chiefly of a house and supplies of potatoes, milk, and oatmeal.

It is difficult to estimate the average earnings of single men. In addition to their cash wage, some of them are boarded and lodged in or near the farm-house, whilst others live in bothies and receive allowances similar to those given to married ploughmen, only less in quantity. Their earnings also vary considerably according to experience and competence. During the last two years the cash wages of single men have been subjected to greater reductions than have those of married men, and now amount to about 20s. per week plus board and lodging (valued at 14s. per week).

Only in the south-eastern counties are women usually employed in the fields, and their present earnings are roughly 22s. per week (including value of allowances). In other parts of Scotland women working on farms on other than temporary engagements generally have to perform the duties of dairymaids or kitchenmaids.

II. *Hours*.—In 1922 and again this year there was a move-

\* From particulars given in a communication received from Sir James Wilson, K.C.S.I., which appeared in full in the *Scottish Journal of Agriculture*, Oct., 1923.

ment amongst farmers in several areas for an increase in working hours. Proposals on the subject in East Lothian led to threats of a strike in that area, and the whole question was referred to arbitration. The decision was that the total working hours in the year as a whole should be increased by 20 for the year ending Whitsunday, 1924. A time-table was subsequently drawn up and agreed to by both parties, in which the working hours are to be reckoned from the time the horses leave the stables to the time when work in the fields stops, the hours (excluding meal-times, which are not regarded as working time) being divided as follows :—

Spring and Summer	$50\frac{3}{4}$ per week	...	} Or an average of about 50½ hours per week for the whole year.
Seed-time (4 weeks)	54 per week ..	...	
Harvest (6 weeks)	$58\frac{1}{2}$ per week ...	...	
Oct. and Nov. (6 weeks)	$50\frac{1}{4}$ per week ...	...	
Nov. to March (18 weeks)	$46\frac{2}{3}$ per week		

Provision has been made for the granting of a half-day from 12 noon on Saturdays in 42 weeks of the year.

These hours are fairly general in all areas for workers other than cattlemen and shepherds. Ploughmen, in addition to the recognised working week, have to spend an average of about 10 hours a week in the stables and in bringing the horses home, thus making their total hours of duty about 60 per week.

\* \* \* \* \*

THE Sheffield Salvage Department has erected, at a cost of £250,000, a complete salvage plant for dealing with town

**Manures from  
Town Refuse.**

refuse and recovering from it products which can be used as manures, etc. The refuse is sifted into three grades. The middle grade, consisting principally of cinders, is used as fuel, and is sufficient to run the whole plant and leave a balance for sale. From the coarsest grade the tins, bones, rags, etc., are collected and the balance is ground and added to the finest grade. This material, which amounts to over 35,000 tons per annum, is described as "special dust fertiliser."

Fish refuse is collected separately daily and manufactured into manure, the output being about 120 tons per annum. Condemned meat is transformed into meat meal, about 25 tons per annum, while "Hairy Guano" is produced from dead cats and dogs, amounting to about 18 tons per annum. Other materials produced in smaller amounts are bone meal, blood and vegetables, yeast and vegetables, dry vegetables, and mussel grit. Further information can be obtained from The Cleansing Department, Town Hall, Sheffield.



THE following notes dealing briefly with certain weeds which are not commonly serious but may on occasion prove trouble-

**Some unusual  
Weeds.**

some, have been communicated by Mr. E. Wyllie Fenton, Seale Hayne Agricultural College:—

*Small Rough or Beaked Hawk's Beard* (*Crepis Taraxacifolia*, Thuill.) and *Larger Hawk's Beard* (*Crepis biennis*, L.), are biennial plants which are very similar and often confused. The former is by no means uncommon in certain localities although rare in others, and both are at times troublesome weeds. As the methods of dealing with them are the same they are here considered jointly. They are generally confined to waysides, waste places and railway embankments, but, like all the Compositae, they have the habit of spreading rapidly under favourable circumstances. At present, they are not often recorded as weeds of any consequence on agricultural land, but since they spread rapidly they may become a nuisance.

One field in South Devon has been overrun with these plants, and during the last two years has been a mass of yellow bloom when cut for hay. As the seeds are formed and practically ready for distribution by the time the hay is harvested, the danger, not only to the field but to neighbouring land, is obvious.

Depasturing, or early cutting of the hay, will do much to keep the plants under control, and if continued systematically, exterminate them. During the drought of the last two summers the deep rooting system has enabled these plants to more than hold their own with grasses and clovers, which normally tend, by competition, to keep them in check.

*Goat's Beard* (*Tragopogon pratensis*, L.) is a biennial and usually confined to banks and waysides, but occasionally wanders into agricultural areas. A case of this kind occurred in Lundy Island during the summer of 1922. It had been present on the same area previously and had not been held in check. The result was that the oat crop was found to be full of it. So plentiful was the weed that it was quite impossible to deal with it without injuring the oats. Even spraying was tried on a small scale without success, for where the Goat's Beard was affected the crop also suffered as heavily. The final result was that the weed and crop had to be harvested together. This meant, of course, that the seeds had escaped before the plants were cut, and that much trouble and probably loss would follow later. As Goat's Beard is a biennial with a thick fleshy root the only means of eradication is prevention of seeding by early cutting; by this means it can be eradicated in a few years.

One of the *Mayweeds* (*Matricaria discoidea*, L.) of comparatively recent introduction is spreading steadily. In most cases it is to be found in patches by railway sidings, canal banks, round farm buildings, and occasionally in waste areas. It seeds very readily and owing to its prostrate growth is most difficult to handle. In the majority of cases it is confined to areas of no agricultural importance, although there are cases on record where this plant has caused damage. In Cornwall a field of oats was practically ruined by this weed one year, and a similar case occurred in Herefordshire. During 1922 part of a field in South Devon was invaded and the barley yield in the area affected was much reduced.

The only known method of controlling this weed at present is deep ploughing. This is not satisfactory, as there is always the possibility that the seeds buried may in the course of agricultural operations be again brought to the surface and the damage repeated, depending largely of course on the crop.

\* \* \* \* \*

ADVICE on the eradication of acarine disease from a stock of bees is given in the Ministry's Leaflet No. 395 (*Diseases of*

**Acarine Disease of Bees.** *Adult Bees*). As, however, no cure for the disease has yet been discovered, the safest course, where a stock has become affected

is to destroy the bees and the quilts and to disinfect the interior of the hive thoroughly by means of scorching with a painter's blow lamp. Should the latter not be available, the walls of the hive and the alighting board should be painted with paraffin and ignited. In this case, when sufficient scorching has taken place, the flames can be quenched by means of a wet sack. The combs may be used again provided they have been sprayed with a suitable disinfectant and allowed to stand for two months.

The following is a simple method of killing the bees in an infected stock. A cartridge made of brown paper should be smeared with sulphur paste and placed in a smoker. The entrance to the hive should be closed by means of earth, with the exception of a small aperture, made with the finger, for the insertion of the smoker-nozzle. After dark, care having been taken that the quilts in the hive fit properly, the cartridge in the smoker should be lighted and smoke puffed into the hive until the brown paper cartridge has been consumed. The aperture should then be closed and the hive allowed to stand for half an hour. The dead bees and the quilts should then be removed and burned in a hole in the ground one yard in diameter and a



foot deep. After all is consumed the hole should be filled in. If the stock has been dealt with in this manner, the spraying of the combs need not be carried out, although the combs should be allowed to stand for two months before re-use.

*Note.*—In Leaflet No. 395 it is stated that the Ministry will test bees for acarine disease for a nominal fee. It is regretted that it has been necessary to suspend this arrangement for the present.

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In view of the fact that many Agricultural Lecturers, County Agricultural Organisers, etc., have only restricted facilities for the use of libraries, the Rothamsted Experimental Station has arranged to have copies taken of any papers or books in their library. Particulars of the charges for various kinds of work, which are strictly moderate, may be obtained from the Director, Rothamsted Experimental Station, Harpenden.

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AGRICULTURAL RETURNS  
OF ENGLAND AND WALES, 1923.

PRODUCE OF CROPS.

*Preliminary Statement showing the Estimated Total Produce and Yield per Acre of the Corn and Hay Crops in England and Wales in 1923, with Comparisons for 1922, and the Average Yield per Acre of the Ten Years 1913–22.*

Crops.	Estimated Total Produce.		Acreage.		Estimated Yield per Acre.			Average of the Ten Years 1913–22.
	1923.	1922.	1923.	1922.	—	1923.	1922.	
			<i>Acres.</i>	<i>Acres.</i>				
Wheat - - Tons	1,515,000	1,674,000	1,740,478	1,966,866	{ Cwts.	17·4	17·0	17·1
Qrs.	6,852,000	7,664,000			{ Bush.	31·5	31·2	31·0
Barley - - Tons	959,000	956,000	1,326,729	1,363,752	{ Cwts.	14·5	14·0	14·7
Qrs.	5,006,000	5,068,000			{ Bush.	30·2	29·7	30·8
Oats - - Tons	1,322,000	1,252,000	1,976,294	2,157,142	{ Cwts.	13·4	11·6	13·3
Qrs.	9,528,000	9,289,000			{ Bush.	38·6	34·4	38·2
Mixed Corn - Tons	83,000	83,000	115,601	123,788	{ Cwts.	14·4	13·3	—
Qrs.	512,000	509,000			{ Bush.	35·4	32·9	—
Beans - - Tons	188,000	188,000	223,422	272,021	{ Cwts.	16·9	13·8	15·5
Qrs.	824,000	837,000			{ Bush.	29·5	24·6	27·0
Peas - - Tons	67,000	57,000	94,670	122,717	{ Cwts.	14·2	9·3	13·4
Qrs.	301,000	261,000			{ Bush.	25·5	17·0	24·2
Seeds Hay* - Tons	2,828,000	1,731,000	1,814,814	1,527,646	Cwts.	31·2	22·7	28·1
Meadow Hay† Tons	4,865,000	4,058,000	4,357,276	4,413,118	Cwts.	22·3	18·4	20·9

\* Hay from Clover, Sainfoin, and Grasses under rotation.      † Hay from Permanent Grass.

Autumn-sown corn was drilled under favourable conditions and came through the winter well. These crops and early spring sowings withstood the cold weather of May and June with little damage, but the later sowings of barley and oats, which were frequently sown into rough seed-beds, suffered

considerably, and many crops were consequently thin and weak. Over the greater part of England the weather was fairly favourable for the harvest, and on the whole the crops were well secured. Conditions have been very different in the north-west and in Wales, where, on high farms, large areas of corn were still uncut at the middle of October, and many of the crops have been severely damaged in the stook by the continuous rains. The estimates for these districts may, therefore, require appreciable revision when harvest is completed. Wheat generally is of good quality, the grain being fairly plump, and the same may be said of winter and early-sown spring barleys and oats, but the later sowings ripened unevenly and are a poor sample.

The total production of Wheat is estimated at 1,515,000 tons, as compared with 1,674,000 tons in 1922, the whole of the reduction being due to the decline in acreage. The average yield per acre is estimated at 17·4 cwts., nearly half a cwt. per acre more than last year and one-third of a cwt. above the ten years' average. The best crops were in the eastern counties, yields being under average in most other counties. Barley is the only corn crop to give an under-average yield, the yield per acre being estimated at 14·5 cwts., or one-fourth of a cwt. below average, but half a cwt. more than in 1922. The total production of 959,000 tons, is very slightly greater than last year in spite of the reduction of 37,000 acres in the area grown. The total production of Oats, 1,322,000 tons, is 70,000 tons in excess of last year's production, as a result of the much better yield per acre, the area having been reduced by 180,000 acres. The yield per acre is estimated at 13·4 cwts., which though only a trifle above average, is  $1\frac{3}{4}$  cwts. per acre better than last year, and the highest yield since 1918. Mixed Corn yielded 14·4 cwts. per acre, and the total production of 83,000 tons was the same as in 1922. The yield per acre of Beans, 16·9 cwts., is 3 cwts. per acre heavier than last year and  $1\frac{1}{2}$  cwts. above the decennial mean, but as a result of the reduced area the total production is much the same as in 1922, viz., 188,000 tons. Although the area of Peas was reduced by 23 per cent., the yield per acre was so much better this year that the total production exceeds that of last year by 10,000 tons or about 15 per cent. The estimated yield per acre of 14·2 cwts. compares with 9·3 cwts. in 1922 and 13·4 cwts. the ten years' average.

The yields per acre and the total production of corn are given in the table both in terms of weight and of measure. When further information is received as to the natural weight of grain of this year's crop the figures by weight may require revision.

"Seeds" sown in 1922 germinated very well, and the crop suffered little damage during the winter, so that there was a strong, thick plant in the spring. Meadow Hay was checked by the cold weather of May, but grew quickly during the warm days of the latter half of June. Over most of the country the hay was secured in good condition, but in the north and in Wales hay-making was very protracted owing to the almost continuous rains, and on hill farms in these districts large areas have never been mown and much hay has been wasted after cutting. The average yield per acre of Seeds Hay is estimated at 31·2 cwts. or 3 cwts. above average,  $8\frac{1}{2}$  cwts. more than last year, and the best yield since 1916. With the area also largely increased as compared with last year the total production of seeds hay, 2,828,000 tons, is over 1,000,000 tons in excess of the production in 1922. The yield per acre of



Meadow Hay, 22·3 cwts., was also above average, being about  $1\frac{1}{2}$  cwts. per acre above the decennial mean, and 4 cwts. per acre heavier than in 1922. The total production of 4,865,000 tons is 800,000 tons greater than last year. Taking both kinds of hay together the production is estimated at 7,693,000 tons, compared with 5,789,000 tons last year and 5,339,000 tons in 1921.

The estimates of the potato and root crops will be issued about the end of November.

### PRODUCE OF HOPS.

*Preliminary Statement showing the Estimated Total Production of Hops in the years 1923 and 1922, with the Acreage and Estimated Average Yield per Statute Acre in each County of England in which Hops were grown; and the Average Yield per Acre of the Ten Years 1913–1922.*

COUNTIES, &c.			Estimated Total Produce.		Acreage returned on 4th June.		Estimated Average Yield per Acre.		Average of the ten years 1913 to 1922.
			1923.	1922.	1923.	1922.	1923.	1922.	
KENT	East ...	Cwts.	37,000	46,000	Acres.	4,095	Cwts.	10·5	11·2
	Mid ...	Cwts.	56,000	72,000	Acres.	5,528	Cwts.	10·7	13·1
	Weald ...	Cwts.	60,000	88,000	Acres.	7,113	Cwts.	8·9	12·4
	Total, Kent		153,000	206,000		16,736		9·9	12·3
HANTS	...	Cwts.	7,900	11,000	Acres.	1,073	Cwts.	7·8	10·3
SURREY	...	Cwts.	1,700	2,200	Acres.	217	Cwts.	8·1	10·1
SUSSEX	...	Cwts.	18,000	33,500	Acres.	2,354	Cwts.	8·1	14·2
HEREFORD	...	Cwts.	30,000	30,000	Acres.	3,945	Cwts.	7·7	7·6
WORCESTER	...	Cwts.	18,000	17,700	Acres.	2,032	Cwts.	9·3	8·7
OTHER COUNTIES*	...	Cwts.	700	500	Acres.	95	Cwts.	7·3	5·2
TOTAL			229,000	301,000	24,893	26,452	9·2	11·4	10·4

\* Salop, Gloucester and Berkshire.

*Note.*—The estimated total production does not include the produce which might have been obtainable from areas left unpicked. The average yield per acre is calculated on the total area under the crop, whether picked or unpicked. The Hop Controller has advised each grower of the quantity he can take into control, and, as a consequence, the area left unpicked is larger than usual.

The total production is estimated at 229,000 cwts., which is 72,000 cwts. less than in 1922, and 38,000 cwts. below the average production in the 10 years 1913–22. In the south-eastern counties the yields per acre are considerably lower than those of 1922, particularly in Sussex, where the crop of the preceding year was very heavy. In Kent the yield is  $2\frac{1}{2}$  cwts. per acre less than in 1922, and  $1\frac{1}{2}$  cwts. per acre lighter than the mean of the previous ten years. Yields in the western counties are, on the whole, rather better than in 1922, the Worcestershire crop being  $\frac{1}{2}$  cwt. per acre heavier than that of last year, which was an average crop, and the yield in Hereford is of practically the same weight per acre as in 1922, and about  $\frac{1}{2}$  cwt. short of the ten-year mean.

**Foot-and-Mouth Disease.**—All restrictions in connection with the outbreaks at Grimsby; Cranleigh, Surrey; Hatfield Heath, Essex; North Farnborough, Hants; West Hoathley, E. Sussex; Sprowston, Norfolk; and Whitchurch, Bristol, have now been withdrawn.

*New Centres of Infection.*—Since the issue of the November *Journal*, disease has been confirmed in the following new centres up to and including 16th November:—

(1) 26th Oct.	Morden, Surrey.	(6) 9th Nov.	Withconsea, Yorks, E.R.
(2) 27th „	Paisley, Renfrew.	(7) 9th „	Tewkesbury, Glos.
(3) 3rd Nov.	Dunfermline, Fifes.	(8) 11th „	St. Nicholas-at-Wade, Birchington, Kent.
(4) 6th „	Upper Wear, Riseley, Beds.	(9) 15th „	Poulton-le-Fylde, Black- pool, Lancs.
(5) 7th „	Ruskie, near Stirling, Perths.		

There is no clue as to the origin of any of these outbreaks, the last of which occurred immediately after the restrictions in force in that portion of Lancashire had been withdrawn on 14th November.

*Summary of Outbreaks.*—(27th August—16th November.) The following table shows the number of outbreaks in each county from the commencement of the present series on 27th August.

County.	No. of Outbreaks.	County.	No. of Outbreaks.
Bedford	1	Somerset	7
Buckingham	5	Stafford	1
Cheshire	74	Surrey	7
Denbighshire	31	Sussex E.	1
Devonshire	4	Worcester	2
Essex	5	Yorks E.R.	3
Flintshire	23	Yorks W.R.	38
Gloucestershire	10		
Hampshire	7	<i>Scotland.</i>	
Kent	2	Dumbarton	5
Lancashire	20	Fife	1
Lincs (Lindsey)	1	Lanark	4
London	1	Perth	3
Norfolk	5	Renfrew	14
Salop	27	Stirling	6
		Total	308

*Slaughtered.*—The numbers of animals slaughtered in connection with these outbreaks are:—Cattle, 9,714; Sheep, 8,115; Pigs, 6,867; Goats, 14; and the gross compensation is estimated at £302,000, of which it is estimated that £70,000 will be recovered by way of salvage.

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## REPLIES TO CORRESPONDENTS.

**Live-weight Increase of various Animals**—E.D. asks (1) what weight of "Starch Equivalent," if properly balanced, is required to put on a pound of flesh when fed to the following (full-grown) animals:—(a) horses, (b) sheep, (c) pigs, (d) cattle; and (2) what live-weight increase will the above (full-grown) animals put on per day when receiving a fattening ration.

*Reply (supplied by the Animal Nutrition Institute, University of Cambridge):* A pound of live-weight increase in the case of a full-grown steer in fresh to half-fat condition contains such an amount of protein and fat as corresponds



to about 3,250 calories. A pound of starch equivalent can supply 1,071 calories, so that practically 3 lb. of starch equivalent should enable such an animal to put on about 1 lb. of live-weight increase. If the animal is in store condition, live-weight increase contains per lb. only about 2,500 calories, so that 2.3 lb. of starch equivalent should enable an animal to put on a pound of live-weight increase. If the animal is nearly fat, a pound of live-weight increase may contain as much as 4,000 calories, and it would consequently take very nearly 4 lb. of starch equivalent to make a pound of live-weight increase in such an animal. In other words the number of pounds of starch equivalent required to make a pound of live-weight increase goes up steadily as the animal improves from the store to the fat condition. The figures appear to be very much the same in the case of full-grown sheep and full-grown pigs. It is doubtful whether any similar figures exist for horses, and as the horse has not been selected for fat production, more starch equivalent would probably be required per lb. of live-weight increase. The amount of live-weight increase which is normally put on by different animals is as follows:—Sheep, rather more than 2 lb. per week; cattle, rather more than 2 lb. per day; pigs, from  $\frac{1}{2}$  to 2 lb. per day, according to age; for horses there does not seem to be any information.

**Lupins and Serradella.**—F.E. asks about the cultivation of these crops for improvement of poor sandy soil.

*Reply:* An article on the "Value of Lupins on poor light Land," by A. W. Oldershaw, Agricultural Organiser for East Suffolk, appeared in this *Journal* for January, 1920.

Serradella is sometimes used as a crop to plough under on medium light sandy soil. It does not give so bulky a crop as lupins, nor is it so commonly used in this country. It may be sown in early spring with a nurse crop of spring oats and be ploughed under after the nurse crop is harvested, or it may be sown alone. About 40 to 60 lb. of seed per acre should be allowed. It is sometimes also sown in spring on a winter crop, wheat or rye.

**Calf Feeding.**—G.F. asks for information as to rearing calves from birth without giving ordinary cows' milk.

*Reply:* Cows' milk is essential for 2–3 weeks after birth, and calves progress much more favourably if new milk is continued for 4 weeks, and if, after whole milk is discontinued, separated milk is given until the age of 12 weeks. When milk or even separated milk is only available in small quantities the directions given on pages 11 and 12 of Leaflet No. 142 may be followed.

**Valuation of Manures.**—H.G., referring to Leaflet No. 72, quotes the price per ton and analysis of two compound manures, and asks how to work out the cost per unit from the price in order to compare the relative value without knowing the market prices of the different ingredients.

*Reply:* It is impossible to work out the value of a compound manure without knowing the current unit prices. These are given weekly in the Ministry's "Agricultural Market Report" for nitrogen, soluble phosphates and potash. The unit value of insoluble phosphates is not given; it must be worked out from the current price of steamed bone flour, thus:—Price per ton steamed bone flour (week ending 12th October) £6 2s. 0d., less allowance 1 per cent. nitrogen (13s.) £5 9s. 0d., divided by percentage total phosphates (60)=approximately 1s. 10d.

## NOTICES OF BOOKS.

**The Chemistry of Food. *A Manual for Poultry Keepers.***—(Lt.-Col. F. W. Hardy, B.A., M.B. London: National Utility Poultry Society, 1923, 47 pp., 2s.) The average poultry keeper, it is feared, does not trouble much about the chemical composition of his feeding stuffs. Usually he is quite satisfied to determine the poultry rations which he uses with little knowledge of their nutritive value, and as long as he gets results, he does not bother further. He should, however, realise that a knowledge of some of the simple scientific factors which affect him in his ordinary daily round will help him to eliminate waste and guide him in the wise choice of his poultry foods. This is where the "*Manual for Poultry Keepers*," by Col. Hardy, which first appeared as a series of articles in the *National Poultry Journal*, will come to his aid. It is a little book written expressly for those poultry keepers who are willing to learn a little chemistry in order to improve their knowledge of the composition and nature of poultry feeding stuffs. Not only is it clearly and concisely arranged, but its lucidity will doubtless give pleasure to many who can remember early struggles with the elements of chemistry. It contains a very useful table showing the chemical composition of the ash of the principal poultry feeding stuffs, and a brief but concise description of the chemical elements and compounds with which the poultry keeper is concerned. The mineral requirements of the fowl, the importance of vegetable acids, carbohydrates, grit, fats and oils, etc., are all dealt with. There are also illuminating and interesting sections on proteins and vitamins, and their practical application to poultry keeping. An effective diagram showing the changes which take place in food stuffs from the time they enter the body of the fowl is also given, and the book concludes with a useful and instructive section on the distinctive chemical and physical properties of various food stuffs, together with a table of analyses.

**Vegetable Crops.**—(Homer C. Thompson. 487 pp. London: McGraw-Hill Publishing Co., 1923. 22s. 6d.) The purpose of this book is to meet the needs of college and university teachers of vegetable gardening, bringing together results of experimental and research work, and this purpose governs the plan. It deals with principles rather than details of practice; with the science rather than the art of gardening.

Interesting definitions of terms often used with different meanings, are:—"Truck Gardening" as the growing of a special vegetable crop or a few crops in large quantities for a distant market; "Market Gardening" as the production of vegetables for a local market—more intensive, but less extensive than the former.

The book is American in conception and range, and the names of some of the vegetables treated of, sound strange to British ears: for example, Udo, Rutabaga, Skirret, Husk tomato, Okra, Martynia. There are sections for the production of canning crops, and for home gardening.

The section on soils and soil preparation is popular and elementary. A plate of one horse drawing a pair of man-guided cultivators among spinach, is an indication of labour-saving ingenuity. The advice to apply well-rotted manure, broadcast it after ploughing and thoroughly mix it with the surface soil by harrowing, strikes the cultivator in this country as strange. The



records of manuring experiments are well tabulated and seem to confirm results here, that moderate dressings of stable manure along with judicious mixtures of chemical manures are economically the best.

The chapter on "Marketing" is thorough and will repay careful study. The present position concerning the standardisation of packages for vegetables by recent legislation in the United States is adequately described.

The spinach disease so destructive here is referred to as spinach blight or mosaic, and it is interesting to note that by crossing a type secured from Manchuria with types in cultivation at the Norfolk (Virginia) Experimental Station, a disease-resistant type has been evolved, called "Virginia Savoy."

Celery is gone into in great detail, doubtless on account of the fact that the crop occupied 20,000 acres in 1919, and was valued at more than nine million dollars.

An important section is devoted to potato crops, which include the Sweet Potato. The annual production of what, for distinction, is called the Irish Potato, in the United States is given as four hundred million bushels; nearly 45 per cent. of all farms, it is said, grow potatoes, and the average yield per acre is 89.3 bushels—say about  $2\frac{1}{4}$  tons per acre! Standard varieties and a classification of potato diseases are given in tabular form and are dealt with excellently.

It is said that Brussels sprouts have not become an important crop in the United States and this is not surprising if the illustration gives a fair specimen of the type produced. There is here surely an opening for seed export from this side. It is surprising also that sea kale is so little grown in the United States.

On the whole, the book will repay study by scientists and teachers. The illustrations are mostly good; the tables are elaborate and instructive; and there is a good bibliography—with two exceptions, transatlantic. The book gives a good idea of the immense ranges of climate and soil conditions covered by the United States of America.

**Agricultural Implements.**—(G. H. Purvis. 110 pp. Ernest Benn Ltd. London. (Successful Farming Series). 1923. 2s. 6d.) This handbook contains a short and simple description of the principal modern agricultural implements, and should be useful to elementary students of agricultural mechanics. An introductory chapter explains the simple mechanical terms and principles and also gives useful guidance with regard to the dissembling, lubrication, and care of implements—matters which are far too frequently neglected on the farm at the present time. The principal tillage implements are then briefly described, followed by cultivating, harvesting and barnyard machinery, dairy appliances, &c., and the book concludes with chapters on prime movers, including agricultural tractors, and the utilisation of wind, water and electrical power. The book is copiously illustrated with appropriate photographs, drawings, diagrams and sketches.

**Dairy Cattle.**—(James Mackintosh, N.D.A., N.D.D. London: Ernest Benn, Ltd., 1923. 1s. 6d. net. 77 pp.) The sixth and last volume of Benn's "Successful Farming Series" deals with the management of the dairy herd for the production of milk. In a simple and instructive manner the author discusses the best type of dairy cow, improvement by breeding and selection, herd management, feeding, hand and machine milking, calf rearing, and the

management of dairy heifers. Written by a recognised authority, this little book can be recommended to all cow-keepers and dairy farmers.

**The Biology of the Fowl.**—(E. Evans, 21, Rydal St., Burley, 1923, paper backs 5s., cloth backs 7s.) Mr. Ernest Evans has prepared this work for the many poultry keepers who have a keen desire to know more of the fowl. Within the compass of 160 pages he has described the physiology of the fowl and of reproduction, the blood and circulation, respiration and ventilation, the digestive and nervous systems, eggs and incubation, and the development of the chick. There are also chapters on foods, feeding, vitamins, heredity, and poultry breeding. This little book, written in lucid style and in simple language, is a useful addition to our poultry literature, and will well repay study.

**Commercial Poultry Raising.**—(H. A. Roberts, 607 pp. London: Chapman and Hall, 1923, 15s. net.) This book now published in London made its appearance in the United States in 1918. The author deals in detail with the problems of the commercial producer of eggs and table fowls, giving particular attention to housing and marketing. Chapters on ducks, geese, turkeys, guinea fowls, and pigeons are included. There are over three hundred illustrations.

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## ADDITIONS TO THE LIBRARY.

### Agriculture, General and Miscellaneous.

*Sinnott, E. W.*—Botany: Principles and Problems. (405 pp.) New York and London: McGraw-Hill Publishing Co., 1923, 15s. net. [58(02).]

*Russell, Sir E. J.*—Farm Soil and Its Improvement. (126 pp.) London: Ernest Benn, Ltd., 1923, 7s. 6d. [63.11(02); 63.16(02).]

*Russell, Sir E. J.*—Rothamsted and Agricultural Science. (13 pp.) London: Royal Institution of Great Britain, 1923. [37(072).]

*Eaton, T. H.*—Vocational Education in Farming Occupations: The Part of the Public High School. (374 pp.) Philadelphia and London: J. B. Lippincott Co., 1923, 8s. 6d. net. [37(02).]

*Barthel, C.*—A Review of the Present Problems and Methods of Agricultural Bacteriology. (116 pp.) Stockholm: Knut and Alice Wallenberg Foundation, 1923. [576.8.]

### Horticulture.

*Thompson, H. C.*—Vegetable Crops. (487 pp.) New York and London: McGraw-Hill Publishing Co., 1923, 22s. 6d. [63.511(02).]

### Plant Diseases.

*Bewley, W. F.*—Diseases of Glasshouse Plants. (208 pp.) London: Ernest Benn, Ltd., 1923, 12s. 6d. net. [63.23; 63.24.]

*Fryer, P. J.*—Successful Spraying and How to Achieve It. (154 pp.) London: Ernest Benn, Ltd., 1923, 7s. 6d. [63.294(02).]

### Live Stock.

*Oregon Agricultural Experiment Station.*—Bulletin 198:—Fattening Lambs on Alfalfa. (16 pp.) Corvallis, 1923. [63.681: 043.]

*Kent, Surrey and Sussex Farmers' Co-operative Bacon Factory, Ltd.*—A Reference Work on Bacon Pigs and Their Factory. (80 pp.) Lenham, 1923, 2s. 6d. [63.64; 664.9.]

*Texas Agricultural Experiment Station.*—Bulletin 305:—Swine Feeding Experiments. (41 pp.) Brazos County.—1923. [63.64: 043.]

### Dairying.

*Leitch, K. H.*—Dairy Farming. (304 pp.) [Scottish Series of Junior Agricultural Textbooks.] Edinburgh: W. Green & Son, 1923, 6s. net. [63.70(02).]

*Mackintosh, J.*—Dairy Cattle. (77 pp.) [Successful Farming Series.] London: Ernest Benn, Ltd., 1923, 1s. 6d. net. [63.711(04).]



# THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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## NOTES FOR THE MONTH.

THE present policy of the Ministry in dealing with foot-and-mouth disease is the stamping-out policy, *i.e.*, the extermina-

**Foot-and-Mouth Disease: The Ministry's Policy.** tion of the virus of the disease by the immediate slaughter of all affected animals and of all other animals which, owing to their close contact with the former, are

certain to become infected. As the virus of the disease from an affected animal can be carried long distances on the feet of other animals, or on the feet and clothes of persons, and even by birds, and may possibly be air-borne, the prompt disposal of affected stock by slaughter is considered the most effective means of eradication, particularly in an island country like our own possessing the natural protection afforded by the sea against the re-introduction of infection by direct contagion.

Exception is, however, made in the case of pedigree stock, valuable not only intrinsically but also from their Herd or Flock Book position. The local circumstances in these cases are often specially favourable to successful isolation, and this class of case presents little difficulty.

The position of Great Britain may be compared with that of certain other countries which enjoy periods of freedom, or comparative freedom, from foot-and-mouth disease, *viz.*, Canada, Australia, New Zealand, the United States of America, Norway and Sweden. These countries, like Great Britain, either prohibit the entry of livestock or protect themselves with drastic quarantine laws against the entry of diseased animals. The first three countries have been entirely free from foot-and-mouth disease for many years. The United States and Sweden have adopted the slaughter policy and it may be assumed that the above-mentioned British Dominions and also Norway would adopt this policy if invaded by the disease.

Other countries in Europe, Asia, Africa and America deal with the disease by isolating infected stocks, regulating stock

movements within their boundaries and quarantining the animals they import, or alternatively let the disease take its course without interference. Denmark and Holland periodically free themselves from the disease but become re-infected from neighbouring countries.

**Comparative Cost of Slaughter and Isolation.**—*Slaughter—Great Britain.*—The Ministry has adopted the policy of slaughter since 1892, and the country has since that year enjoyed considerable periods of freedom from the disease, viz., from 1895-1899, 1903-1907, 1909 and 1917. Every fresh invasion has been dealt with rapidly by slaughter, at a total cost of £943,176 in compensation for animals slaughtered during the 31 financial years ended 31st March, 1923. Estimating the total value of the animal stock of Great Britain, consisting at June, 1923, of 7,013,025 cattle, 20,598,331 sheep, and 2,796,531 pigs, at about £300,000,000, the compensation is equivalent to the payment by the State of an annual insurance premium of about £30,000, or 2½d. per £100. If the last two years (1922-23), which can justifiably be regarded as abnormal, are excluded, the average annual cost of keeping the country free from the disease by the slaughter policy was little more than £9,000.

It has been contended that the slaughter policy seriously depletes the livestock of the country. The adoption of that policy in 1922 (the worst year since 1884) involved the slaughter of 24,071 cattle, 21,831 sheep, and 9,821 pigs. These figures represent but a very small percentage of the total number of animals of each class in Great Britain, viz., cattle, 0·35 per cent. (or 35 per 10,000); sheep, 0·1 per cent. (or 1 per 1,000); and pigs, 0·36 per cent. (or 36 per 10,000).

The numbers of animals which have been slaughtered, or have been authorised to be slaughtered up to 20th December in connection with the present outbreak are 47,388 cattle, 20,747 sheep, and 24,999 pigs. The percentage relation of these figures to the livestock population is cattle, 0·67 per cent. (or 67 per 10,000); sheep, 0·1 per cent. (or 10 per 10,000); and pigs, 0·90 per cent. (or 90 per 10,000). So far, therefore, as their effect upon the livestock population is concerned, the number of animals slaughtered is negligible. It may be observed that the figures above quoted representing the livestock population in June, 1923, are, notwithstanding the adoption of the slaughter policy in 1922, the highest figures recorded for the past 4 years in the case of cattle, for the past 5 years in the case of sheep, and for the past 12 years in the case of pigs.



The *United States* suffered a severe visitation in October, 1914, after a period of five years' freedom. In this case the disease spread in three months to 210 counties in 18 separate States. As the Chicago stock-yards became infected the position appeared desperate, but the United States Government did not hesitate ruthlessly to slaughter every affected animal and succeeded eventually in clearing the country of the disease by May, 1916, at an expenditure of £1,500,000, equivalent at the present day to an expenditure in this country of not less than £2,500,000. Since the year 1916 the United States has been free from the disease.

*Isolation.*—*Great Britain* (1870-1884).—The annual loss from mortality and from deterioration in flesh and milk of affected animals in the countries which adopt isolation in lieu of slaughter can only be vaguely estimated. Reference to early reports concerning the disease in Great Britain shows that the losses through deaths, depreciation in affected animals, loss of young stock, loss in milk and butter, and in other necessary expenses, in the counties of Cumberland and Westmorland, for which an estimate exists during seven years preceding 1878, were not less than £43,000 per annum. If this estimate be extended to the whole of Great Britain, the annual loss through the disease at that time would be put at about £1,500,000 per annum in the lower values of that day. It may be mentioned, in passing, that after 1878 in these two counties a policy resembling our own present policy of slaughter was put into force, and seven outbreaks only of the disease occurred in the next six years. In each of these outbreaks the disease was prevented from spreading beyond the farm or premises in which it appeared, and this at a time when much disease was prevalent in the country as a whole.

*Holland.*—The Ministry is informed that a policy of slaughter was attempted in Holland a few years ago, but that this was abandoned when the expenditure reached £500,000. It was subsequently found that the annual loss to farmers from the disease being allowed to gain a footing through the adoption of the isolation policy reached £2,500,000.

*France.*—It is estimated that the losses in France, where the isolation and treatment policy is adopted, amounted in a recent year to at least £5,000,000.

**Stock Movement Restrictions.** — *Slaughter.* — By rapid slaughter and disinfection, the inconvenience and loss to farmers due to restrictions on movement are reduced to a minimum, as this policy enables the restrictions to be withdrawn

after a comparatively short period, usually about five or six weeks in the case of an ordinary outbreak, except on the infected place itself, where the restrictions are maintained for two months, or six weeks from the completion of disinfection.

*Isolation.*—With the adoption of isolation it would be practically impossible, judging from Continental experience, to prevent the disease spreading and becoming endemic. Restrictions on movement and marketing of all stock within 15 miles of an outbreak would be imposed—as under the present system—and they would have to be maintained so long as active centres of the disease existed. This would mean the maintenance of restrictions for long periods over large areas. The movement of stock from the infected farm, and in some cases from adjoining farms, would have to be prohibited for probably six months. Even then, all danger of recovered animals affecting any susceptible animals with which they come in contact would not have entirely ceased.

In Switzerland all animals after recovery from an attack are branded and may not be mixed with unbranded stock for eight months.

Great Britain is more unsuitable for an isolation policy than the Continent, as in this country sheep stock greatly preponderate and these cannot be successfully isolated, as in many districts they run together in thousands on common pasture ground.

**Export Trade in Pedigree Stock.**—The export trade of this country in pedigree stock is a very important and valuable one. In the four years, 1913, 1919, 1920 and 1921, the average annual value of the export trade in cattle, sheep and pigs was £700,175. Foreign Governments impose restrictions on the importation of stock from Great Britain when disease exists and the export trade in 1922 was on this account reduced in value to £230,925. If disease became endemic, as it almost certainly would under a policy of isolation, the export of pedigree stock to those countries which have been our best customers would cease.

**General Conclusion.**—If the policy of isolation and treatment could be made effective, it is reasonable to conclude that such would have been the result in Continental countries such as France and Germany. Those countries have, however, failed to prevent the disease spreading and becoming endemic.

The abandonment of the policy of slaughter in favour of one of isolation and treatment in Great Britain would be tantamount to admitting that notwithstanding the natural protection afforded by the sea, this country must in future place



itself on a level of equality with other Western European countries as regards foot-and-mouth disease. The disease could not be prevented from becoming endemic, and the losses and inconvenience to farmers and livestock traders which would result from the disease and from the operation of restrictions imposed, not only by the Central Authority, but also by the various County Authorities, would become permanent, and the internal trade of the country in stock would suffer considerably.

The average annual losses to the country might easily reach as high as £2,000,000, compared with the average annual cost of £30,000, incurred in carrying out the slaughter policy during 31 years.

Finally, this country would lose its pre-eminent position as regards the export trade in pedigree stock.

**Opinion of Departmental Committee of 1922.**—The Departmental Committee which enquired into the widespread outbreak of foot-and-mouth disease in 1922 stated in paragraph 100 of their Report (Cmd. 1784) dated 7th December, 1922, as follows:—"We are in agreement with the majority of the witnesses who have stated their opinion that the policy of slaughter is the correct one and should be maintained."

**Relation of Question of Isolation to the Outbreaks of 1923.**—The present series of outbreaks commenced at the end of August, 1923. One very disturbing feature has been the number of apparently unconnected centres of the disease established in widely separated localities, in which Scotland as well as England has been involved; another is the extraordinary rapidity with which infection has spread from farm to farm in the North Midlands Area (Cheshire, Salop, Denbighshire and Flintshire). Until the third week in November the new centres (with the exception of the Cheshire Group) were by the established method of slaughter being quickly stamped out, and no fewer than 16 of those centres no longer exist. On the 18th November, however, some pigs moved to Newcastle from premises in Scotland on which foot-and-mouth disease was discovered three days later contaminated the loading docks at Newcastle and also the markets at Newcastle and Gateshead on the 19th and 20th November. Infection was picked up in those places and taken to certain other markets and thence to numerous farms in Northumberland, Durham, Yorkshire, Derbyshire, Nottinghamshire, Staffordshire and Leicestershire. This unfortunate occurrence was the direct cause of some 160 further outbreaks and materially increased the difficulties of eradication. There is now nevertheless reason to think that all

known centres of infection, except that in the Cheshire Group, are well in hand. In the latter, however, the disease continues to spread, at the date of going to press, at the rate of more than 20 fresh farms daily.

The problem has now resolved itself largely into one, firstly, of checking further spread of the disease in the Cheshire Group, and preventing its escape from that area, and, simultaneously, of securing the elimination as quickly as possible of other centres of infection still existing and also of those which may yet appear. Both of these objects would be retarded by the adoption of isolation of affected animals, which would mean the upkeep of large numbers of centres for the manufacture of fresh virus and expose the remainder of the country to the danger of re-infection. If such a procedure were applied to the Cheshire area—

(1) the area would have to be isolated from the rest of the country for many months;

(2) it would be impossible to re-stock farms now empty for an indefinite period, as the animals would almost certainly fall with the disease; and

(3) its milk and dairy products would be enormously interfered with.

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THE Ministry desires again to call attention to the possible risk of foot-and-mouth disease being transmitted to flocks and herds in this country by means of hay and straw used for the packing of foreign imported goods.

**Warning Against  
Hay and Straw  
Used for Packing.**

This question was considered by the Departmental Committee appointed by the Minister in 1912 to inquire into foot-and-mouth disease in Great Britain. In their Report, that Committee pointed out that numerous imported articles are packed in hay and straw, and that a large proportion of this packing ultimately reached the farm as manure. That Committee considered, and the Departmental Committee appointed in 1922 supported the view, that hay and straw used for packing constituted a possible medium for the introduction of disease into the country, but in view of the serious dislocation of general trade which the prohibition of its use would entail, neither Committee was prepared to recommend the issue of restrictions to that end.

All persons using such hay and straw are, however, warned of the element of danger which it contains, and of the risk of allowing it to come in contact with any animals.



THE Ministry's annual report on the acreage of crops and number of live stock in England and Wales in 1923 has now been published. Preliminary figures for the whole country were issued in August, see page 569 of this *Journal* for September, but the appendices to the annual report give the finally revised figures for each county.

**Agricultural  
Returns, 1923.**

The chief changes in cropping as compared with the previous year are discussed in the report, and a table is included showing the distribution of arable land among the different crops over a period of years. The efforts made this year to obtain data as to fruit which will afford a better basis for estimating the total production are dealt with at length. The returns of the number of orchard trees show that there are nearly 22,000,000 fruit trees on agricultural holdings in England and Wales.

In the report on live stock a table is included which shows that over a long period of years the supply of cattle for beef production has been practically stationary, the increase in the total number of cattle being almost wholly due to the increase in milk production. A similar table as regards sheep indicates that whereas in Wales the number of sheep per 1,000 acres has increased in the past forty years, and in the north and north-west of England there has been no great decline, in the eastern counties there were only 173 sheep and lambs per 1,000 acres in June, 1923, against 564 in 1875-79.

Returns of the number of agricultural workers employed on 4th June, 1923, are also included in the report. These show that between June, 1921, and June, 1923, the number of regular workers on agricultural holdings declined by 59.952 or nearly 9 per cent.

The Report, which forms Part I of the Agricultural Statistics, 1923, is published by H.M. Stationery Office, and may be purchased through any bookseller or from the Stationery Office Sale Office, Kingsway, W.C.2, price 1s. 6d.

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THE Ministry desires to announce that the Cattle Testing Station at Pirbright, Surrey, will be closed as from the 1st March, 1924.

**Closing of the  
Cattle Testing  
Station, Pirbright,  
Surrey.**

Hitherto exporters of cattle to South Africa have been required under the regulations of the Government of the Union of South Africa to place their animals at the Pirbright Station for 28 days quarantine prior to the application

of the tuberculin test immediately before exportation. In view of the closing of the Station, no more animals will be received there. Animals already at the Station will complete their quarantine and testing there before export, and will not be tested again on arrival at South Africa, provided that they are accompanied by the usual certificate from the Ministry that they have passed the tuberculin test at the Station.

In regard to the cattle not admitted to the Pirbright Station, it is observed that under the present regulations of the Union of South Africa cattle imported from countries from which importation is not prohibited and in respect of which no arrangement has been made for quarantine and test at a Government Testing Station are required to be quarantined for at least 28 days and subjected to the tuberculin test at the port of entry. Any animals which react to the test may be destroyed without compensation, or the owner may be required to re-export them to the country of origin at his own expense.

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THE Annual Report on Animal Diseases in 1922, by Sir Stewart Stockman, the Chief Veterinary Officer of the Ministry, has now been published. It is of special interest on account of the history which it gives of the outbreak of foot-and-mouth disease in 1922, the largest and most widespread since 1884. The outbreak commenced in January, 1922, at Hull and Newcastle, and spread in the course of six months to 1,125 premises in 30 counties in England, 1 in Wales, and 13 in Scotland. Charts are included which show the progress of the disease, and the chain of infection of markets in January to which its spread was mainly attributable.

The report also includes a *résumé* of the general conclusions of the Departmental Committee appointed under the chairmanship of the Rt. Hon. E. G. Pretyman, M.P., to inquire into the origin and circumstances of the outbreak, and the policy and procedure pursued in connection therewith, and to report whether any alteration of the methods of administrative control or of the existing law is necessary or desirable.

As regards other animal diseases, the report shows that continued progress was made towards the eradication of glanders, that there was an appreciable decrease in the number of outbreaks of sheep scab, and that only half the number of cases of parasitic mange in horses occurred during 1922, as compared



with the previous year. On the other hand, outbreaks of swine fever and anthrax showed an increase.

The second part of the report is occupied by an account of the measures taken to prevent the introduction of disease from abroad, and to protect animals from avoidable suffering in transit by land and sea, notably in connection with the exportation of horses to the Continent. It includes a summary of the events of the year leading up to the passing of the Importation of Animals Act of December, 1922, which permitted the importation of Canadian store cattle.

The report concludes with a record of the work at the Government Cattle Testing Station, Pirbright, and of the diagnostic and other business transacted at the Veterinary Laboratory, New Haw, Weybridge. Copies are obtainable through any bookseller, or directly from H.M. Stationery Office, Kingsway, W.C.2 (or Manchester, Edinburgh, and Cardiff), price 3s. 6d. net, post free 3s. 7½d.

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THE following note describing the Government Pavilion at the British Empire Exhibition has been issued by the Exhibition Authorities. The Pavilion will include an Agricultural Section in regard to which information will be given in subsequent issues of the *Journal*.

**The Government  
Pavilion at the  
British Empire  
Exhibition, 1924.**

“For the British Empire Exhibition, which will open at Wembley in April next, the British Government is erecting a Pavilion of appropriate dignity of structure and design. The Royal Suite for the use of the King and Queen will overlook the portico, which will be supported by columns thirty-two feet high, and will be guarded by six massive lions, symbolical of the might and dignity of the Empire. The navy, army and air force are organising impressive displays, and many important aspects of Empire communication, trade, and settlement, and Imperial economic development will be presented. On a water stage seventy feet wide, which, by an ingenious mechanical arrangement, can be converted in a few minutes into an ordinary stage for other displays, certain historical episodes on sea and land and in the air will be realistically reproduced. The Air Force exhibition of models will be supplemented by exhibits of actual aeroplanes and aircraft in an aerodrome easily accessible from the Exhibition grounds. In the Central Court of Honour of

the Pavilion a gigantic model relief map of the world will show by changing lights the growth and extent of the Empire, its resources, development and population. The home country's productive capacity in relation to its ability to manufacture goods for export, and the importance of British overseas trade, will also be illustrated by a large scale model of Great Britain and Ireland. In an annexe there will be a cinema theatre where films of Imperial interest will be in continuous display. The Royal Mint, which will show a complete set of coins of the Empire and of British war medals, will strike special commemorative plaques. The Post Office exhibit will illustrate the most up-to-date methods in the organisation of postal services as well as the recent developments in telegraphy, telephony and wireless communication. Medical and scientific research will be illustrated, and an important exhibit will be that relating to tropical health and hygiene. The Empire's contribution to the progress of modern science, both pure and applied, will be shown by the Royal Society in a manner likely to appeal to the popular imagination. The Ministry of Health, Ministry of Agriculture, Mines Department, Imperial Mineral Resources Bureau, Royal Botanic Gardens at Kew, and the Geological and Ordnance Survey will all be attractively represented."

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THE Denbigh and Flint Committee has agreed that wages shall remain unchanged until 30th April next. The rates are 33s.

**Conciliation  
Committees  
in Agriculture.**

for 61 hours for adult horsemen and stockmen, and 27s. 1d. for 50 hours for other adult male workers. Provision is also made in the agreement for payment at proportionate rates to certain juvenile workers, and for a weekly half-holiday whenever possible.

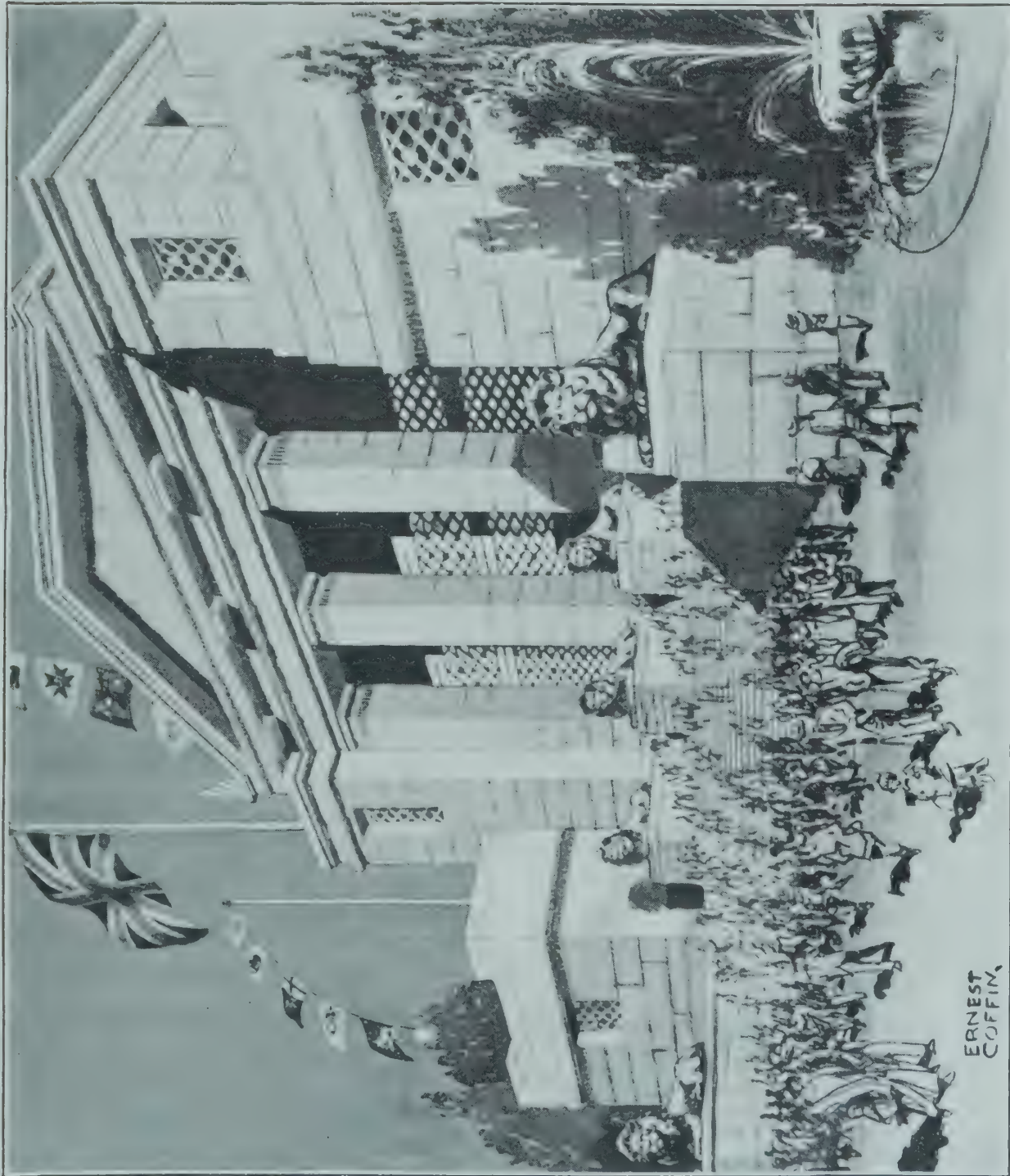
A further wages agreement has been reached by the Carnarvonshire Committee. The terms, which are to remain in force until 13th May next, are as follows for male workers over 20 years of age :—

*Special Class Workers living out.*—35s. for a week of 61 hours (to include the Sunday feeding and cleaning of stock). *Special Class Workers boarded and lodged on farm.*—33s. 6d. for 61 hours, the deduction in respect of the provision of board and lodging being reckoned at 14s. for 7 days and 12s. for 6 days.

*Other Workers.*—30s. for a 50-hour week.

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ERNEST  
COFFIN

Government Pavilion at the British Empire Exhibition (see p. 889).





## CO-OPERATIVE MARKETING IN THE UNITED STATES OF AMERICA.

RECENT developments in co-operative marketing in the United States seem to mark an epoch in agricultural organisation. As in other countries the movement has passed through an experimental stage, a period of trial and error, out of which it now seems to have emerged with certain definite principles which are the direct result of practical experience. During the past few years, the progress has been most striking, and it is hardly too much to say that co-operative marketing is at the present moment the dominant movement in American agriculture.

Co-operative marketing in the United States started with dairy produce in the early part of the 19th century. It passed through a phase when it formed part of what was known as the "Grange Movement" founded in 1867, and the period between that year and 1880 saw the rise and fall of innumerable co-operative enterprises engaged in the marketing of grain, cotton, livestock, tobacco, wool and other produce. A failure to meet the real economic needs of agriculture, combined with radical mismanagement, brought this movement to sudden collapse, just as in Europe the application of the "Rochdale" principles to the marketing of farm produce—i.e., the marketing of a large number of agricultural products through one association—led to an almost equally conspicuous failure.

**Governing Principles.**—In its subsequent development, there have by degrees become recognised certain governing principles which may briefly be summarised as follows:—

1. The organisation of sale must be on a "commodity" basis and not by locality, that is to say, whilst there must be local organisation for receiving, packing and grading, the organisation as a whole must cover a wide producing area, and the local units must be federated in one central body in order to secure adequate control of the market.

2. The supply of produce must be regulated by binding contracts under which the growers pledge their produce to the association for a term of years.

3. The products must be pooled according to size, grade or other characteristic, so that whilst individual growers obtain returns in proportion to the amount and quality of their produce, the organisation of sale passes from these thousands of individual growers into the hands of one organised unit.

How these principles came to be evolved may be illustrated by examples from what actually occurred.

1.—Growers of citrus fruit (mainly oranges) were among the pioneers of the American co-operative marketing movement. The first attempt at co-operation in this trade dates back to the early days of commercial orange production on the Pacific Coast. Between 1877 and 1890 there was a very rapid development in the orange trade in California which soon resulted in "over-production"—there was a "boom" which was speedily followed by a general fall in prices. After an abortive attempt at self-protection through the agency of the Orange Growers' Protective Union, the growers turned to co-operation. The actual beginning was marked by the organisation of the Pachaffa Orange Growers' Association in 1888. Other local associations quickly sprang up, and succeeded in securing fairly good prices in the years immediately following, and during the early 'nineties. They were, however, hardly more than local marketing agencies disposing of their members' fruit in each district independently.

The next step was the establishment of district exchanges in each of the chief producing areas operating in conjunction with the local growers' associations. The organisation of local associations and district exchanges, however, was not enough. It gave the growers no real control over the marketing of the fruit, the associations competed against one another, and the market still tended to be flooded at the time of harvest, and prices to be depressed. Growers therefore sought to federate the local associations into one central body, and ultimately, in 1905, the Californian Fruit Growers' Exchange, the central marketing authority for the united organisation, was established. Thus the last link in the chain came to be formed; federation proved to be the way to success, and with the advent of the California Fruit Growers' Exchange the co-operative organisation for the first time obtained a commanding position in the market. This exchange has dominated the market practically since its inception, and with its formation the general structure of the marketing organisation, viz., local associations—district exchanges—central exchange, was complete. Upon this pattern the whole organisation as it exists to-day has been built up. At present there are 10,700 growers each contracting to deliver the whole of his fruit to the local association. There are 206 local associations concerned primarily with grading and packing, 19 district exchanges whose chief function is



directing the fruit received from the local association to the markets, and finally the central co-ordinating body, the California Fruit Growers' Exchange. Upon the latter by reason of its commanding position falls the task of controlling distribution, of preventing congestion, and thus of securing to the grower what is the real achievement of co-operative organisation—a stabilised market.

2.—The second of the principles referred to above, viz., long-term producers' contracts, was evolved largely as a measure of self-protection. Many co-operative enterprises had in the earlier stages of their existence to withstand attacks from private dealers who endeavoured to tempt producers out of the co-operative organisation by offering high prices for their produce. It was precisely this difficulty which confronted the Danish co-operative movement in its earlier years, in fact, the long-period producers' contract applied to co-operative marketing, is a Danish invention, from which country it was adopted by the United States. Producers' contracts were first used in America by a Farmers' Elevator Co. in Iowa in 1889: they were adopted by the California orange trade in the early 'nineties, and at the present time have become almost the only practice of co-operative undertakings in that country.

The advantage of the contract system, however, is not confined to eliminating the disruptive attacks of outside dealers. It also adds greatly to the power of the co-operative organisation to control the markets, since the volume of produce to be handled is fixed within comparatively narrow limits, thus enabling the marketing policy to be developed with a fairly definite knowledge not only of the present but of the future supplies of fruit to be handled.

3.—The principle of "pooling" has, with a few exceptions, also become the recognised practice of American co-operative marketing associations. Here again its adoption has been the outcome of practical experience. It has been found that it both cheapens the operations of grading and packing, and enables an association to establish a reputation for its products in the market, to reduce wastage to a minimum, and to handle the various grades more easily. Pooling usually consists not merely in the physical mixing together of the growers' produce according to grades, but in the transfer of the control of sale combined with a proper distribution of the profits realised amongst the members of the association. It greatly facilitates, indeed it is essential to, the exercise of the association's full

powers of control over the movement of produce to the market, and it has consequently come to be recognised as one of the primary instruments of market stabilisation. Pooling in this sense is not, however, invariable.

**Economic Difficulties.**—With co-operation established on these guiding principles, American agriculturists have sought to apply it on a wider scale, in remedying the specific economic difficulties which beset the marketing of agricultural produce. These are principally three in number: (1) Seasonal fluctuations in prices; (2) Fluctuations in prices due to temporary excess of supply over demand, *i.e.*, in consequence of exceptionally heavy crops; and (3) Wastage due to deterioration.

In order to overcome these difficulties, the recent development of the co-operative marketing movement has aimed not merely at eliminating the middleman and replacing him by a co-operative society—the advantage of which to the farmer is at best small, and often negligible—but rather at putting into the farmer's hands an effective instrument by which he can prevent or at least minimise violent fluctuations in prices.

That the seasonal drop in prices at harvest time is largely due to financial causes (*i.e.*, to the farmers' need for ready cash) is well recognised. In the United States it has been estimated that only 12 per cent. of the farmers are able to finance their own crop raising. Consequently the practice of unloading their produce on to the market at the earliest opportunity, both in order to raise money to meet their current obligations and to provide for subsequent operations, has been widespread amongst growers in every branch of agriculture. Of the cotton crop 70 per cent. is said to be dumped on the market by farmers during the period, September-December, and 65 per cent. of the wheat is marketed between the beginning of August and the end of November.

The farmer's need to raise cash on his produce lies at the root of the whole question; it is from one point of view the crux of the marketing problem, and it is because in the past—in a system of unorganised competitive marketing—he had no course open to him but to sell his produce outright for what it would fetch, that he remained a helpless victim of the seasonal slump in prices which not infrequently fell below the cost of production.

**Control of Produce, and Bank Credits.**—To meet these difficulties American co-operators have primarily endeavoured to secure two things: (1) the physical control of the movement of



produce to market on the lines which have been described above, to an extent which gave the co-operative organisation a predominant position in the market; and (2) power to obtain bank advances by using the commodities themselves as collateral security. In practice this has involved an intermediate stage between the producer and the consumer in which the product is put into store—in the case of certain perishables into cold storage, and in the case of non-perishables into warehouses or other stores. Upon warehouse receipts the banks have been ready to make advances to co-operative marketing associations, on the same lines as has for many years been their practice in the case of wheat stored in elevators and cotton in warehouses. The association is thereby enabled to make an immediate advance to the growers—up to 50 or 60 per cent. of the market price—and still to retain control of the rate at which the produce is moved to the market. The development of this side of marketing operations has led to a considerable extension of the use of credit as a means of securing stabilisation of prices, and in the crisis which followed the general slump in prices in 1920 this machinery proved to be of the highest importance.

In 1922, the War Finance Corporation, a State credit institution with a capital of \$500,000,000 created and guaranteed by the United States Government, was resuscitated, largely for the purpose of assisting agriculture over the crisis. During the season 1921-22 the Corporation authorised loans amounting to \$64,000,000 to co-operative marketing associations, and in the following season similar loans were approved to the extent of \$114,000,000 “to assist in the orderly marketing of the 1922 crops.”

One quotation may be given from the annual report of the War Finance Corporation for the year ending 30th November, 1922, to illustrate the effect of these operations.

“In the midst of the worst depression that the cotton industry has suffered in many years it was through the co-operative marketing associations that the War Finance Corporation developed plans for extending assistance to the industry on a comprehensive scale. In the summer of 1921 when . . . business throughout the Cotton Belt was in a demoralised condition, the corporation made its first loan to an association in Mississippi on 100,000 bales of cotton. The cotton was classified by the association according to grade and staple, and placed in bonded warehouses. . . . The loan enabled the association not only to make advances to its members for their urgent financial

needs, but also to market the crop through a greater portion of the consuming year, instead of forcing it on a demoralised market."

Co-operative marketing plus State credit, proved in the period of crisis to be a means of stabilising the market, of preventing panic, and of restoring confidence, which was of almost incalculable benefit to farmers, and as a direct consequence of its success, a new impetus was given to the co-operative movement itself under which many new marketing associations were organised for handling cotton, wheat, tobacco, rice and other staple products.

Turning to the other aspect of the question—the control of the physical movement of produce to the market, the most significant development in this direction has occurred in the case of perishables. In those organisations where the development towards federation has reached the point of giving them a dominating position in the market, control of the movement of produce has become a systematised practice. Although production necessarily varies with seasonal conditions, it has become possible, through co-operative enterprise, to secure that the rate of delivery to market is determined by the demand of the market and no longer by the rate of production. Thus, in the case of butter and cheese the rate of production rises during the first half of the year to a maximum in June and thereafter declines to a low point in December, whilst the rate of consumption is relatively steadier throughout. From about the middle of April to the end of August there is consequently a definite "into storage" period during which the association receives from producers more than it sells, and from the beginning of September till the middle of April an "out of storage" period during which these conditions are reversed. Thus the market is supplied according to its needs and fluctuation in prices is reduced to a minimum.

**Marketing of Wheat.**—In recent months much attention has been directed by American agriculturists to what is perhaps the greatest marketing problem in the world—that of wheat. Both on account of the widespread depression of wheat prices and of the predominant importance of wheat amongst the agricultural products of the United States the present position in regard to the problem of orderly marketing of the wheat crop of America is one of exceptional significance. The marketing of wheat in the United States is a highly organised business. The system of bulk handling, storage in elevators, and bank credits, combined with highly skilled technical management,



has led to an organisation in some respects without parallel in the world. It is, however, not an organisation built up on the principles which American agriculturists have now come to know as "orderly marketing"; it does not embody those elements by which alone stability of prices can be secured. Fundamentally the wheat organisation has been developed round the "speculator"—the person who buys from the farmer at harvest time when the grain comes into the market in a greater volume than the current consumptive needs, and sells it again after the flood is over. To the speculator fluctuations in price are not necessarily an evil and may be a source of considerable profit.

The movement for the co-operative ownership by farmers of grain elevators has in the past years undergone considerable development, but its success has necessarily been only a partial one. It has enabled farmer members to obtain credit on their produce, and to this extent has rendered an important service, but it has not achieved its ultimate object. The flow of grain to market still continues in a disorderly fashion and prices tend to fluctuate as widely as ever. The bulk of the crop is still sold by farmers soon after harvest, and the farmer has to be content with what he can get.

The continued depression in wheat-growing districts and the increasing political pressure which was being brought to bear on the United States Administration recently led the President to appoint a Commission consisting of Mr. Eugene Meyer, Jr., and Mr. Frank Mondell, of the War Finance Corporation, to investigate the wheat situation. The Commissioners examined various proposals, and their conclusion is significant: "Co-operative marketing associations organised along sound lines and with competent management and business guidance, offer, at the present time, in our opinion, more promise of helpful results than any other plan or programme that has been suggested. They can do what the speculator cannot with safety be relied upon to do. They can by orderly marketing regulate the flow of wheat so that supply is adjusted from time to time to the consumptive demand."\*

Co-operation is daily becoming more widely recognised in America as the cure for fluctuations in wheat prices. What has been wrong is partly that the principles of co-operative marketing have not been strictly applied in the case of grain,

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\* Report to the President on the wheat situation, by Eugene Meyer, Jr., and Frank W. Mondell.

and partly that the practical difficulties are greater than in other branches of agriculture. With greater knowledge of the economic conditions of grain marketing, however, there would seem every reason to believe that these difficulties will eventually be overcome. The progress of organisation of wheat marketing in the United States during the next few years cannot but form one of the most interesting, possibly one of the most far-reaching experiments in co-operation in any country in the world.

**Co-operative Marketing of other Produce.**—It would be beyond the scope of this article to describe how these principles have been applied in other branches of agriculture, but there is no doubt that the success of the co-operative marketing movement\* during the critical period of 1920-1922 has been the reason of its subsequent very rapid growth. In 1922 the turnover of American co-operative marketing enterprises exceeded one thousand million dollars—a five-fold increase within a decade. Most of the principal farm products are now successfully marketed through co-operative organisations, ranging from a small proportion of poultry and vegetables up to 75 per cent. of American-grown citrus fruits, 90 per cent. of dried fruits, 70 per cent. of tobacco, while they also deal with 25 per cent. of milk and milk products, and 20 per cent. of cotton. In all about 1,200,000 farmers belong to these commodity organisations, the cotton associations of the Southern States—to take an example—having a membership of more than 200,000. In regard to the latter it has been stated that every member who marketed his crop last year through a cotton association received at least \$20 per bale more than the non-members received for the same grade and quality of cotton.

In conclusion, two quotations may be given from a book† on which much of the information in this article is based:—

“Intelligent merchandising of farm commodities through co-operative associations leads finally to a stabilised agriculture, in which fluctuations in prices are minimised, risks of operations greatly reduced, and a premium placed upon the farmer’s ability as a producer.”

“The farmer retains his individualism as a producer, but he puts group selling to work as his sales manager. Neighbour

\* See the *Statist* article on “The Growth of American Co-operative Marketing,” 24th November, 1923, p. 710.

† “Co-operative Marketing: The Golden Rule in Agriculture,” by Herman Seen, American Farm Bureau Federation Library; Doubleday, Page & Co.



joins with neighbour, they pool their product, each man has one vote in the control, and they share and share alike in a new system of economic justice for agriculture."

\* \* \* \* \*

## PIG-KEEPING.

### V.

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*Northamptonshire Farm Institute.*

*General Principles in the Construction of Pig Sties—  
Shelters for Open Air Pig-keeping—Fencing—Appliances  
for weighing Pigs.*

**Permanent Pig Sties.**—It has been pointed out by Mr. Sanders Spencer that pig sties may be described as of three kinds—those which are ornamental, those which are useful, and those which are neither one nor the other. It has been our experience that the conventional type of sty usually belongs to the third class. Pigs, however, do not require elaborate or expensive housing. It is not within the scope of this article to deal in detail with the planning of modern piggeries, but certain broad principles which should be observed in their construction would appear to bear repetition, as they are by no means uncommonly neglected.

The main points of importance in a pig sty are that it should protect the pig from excessive cold and heat, from rain and draughts, and more particularly from cold winds from the north and east. It should be well ventilated and airy. Sun is one of the best germicides and it will help to maintain healthy conditions if the sun's rays can penetrate to all parts of the sty in the course of the day. On the other hand, it will be found a great advantage in hot weather if some simple means of excluding the sun's rays is also provided. Wooden shutters on hinges might serve the purpose in certain circumstances. Many sties which are built facing south without some provision of this sort become unbearably hot during the heat of summer.

The floor should be made of material which will enable the sty to be thoroughly cleansed and disinfected from time to time. Concrete forms a sanitary and inexpensive floor, but it is cold, and if it is not possible to give a liberal supply of bedding it is a good practice to provide a movable wooden platform for the pigs to lie on. It is essential that this platform should not be

a fixture but such that it can be taken out of the sty to be cleansed and exposed to the sun, when it has become wet and dirty through absorbing moisture. It is decidedly prejudicial to the health of the pigs to have them lying on an evil-smelling and urine-soaked platform.

Bricks laid in concrete or in sand are usually regarded as forming a satisfactory floor. In comparison with concrete, bricks are rather warmer but less sanitary. Floors are fairly commonly made of rammed clay or chalk. These are fairly satisfactory but pigs are inclined to root them up, and they are not impervious to moisture. With regard to drainage, surface drainage is the more sanitary; and it is important to see that sufficient fall is provided.

Sties are often built with low walls, and with one small permanent opening leading into a little yard. These low walls are possibly favoured for economy in building, but low-walled sties are rarely really healthy. The atmosphere is usually close and stuffy, and they are uncomfortable both for the pig and for the man who has to clean them out, as he has to work in a crouching and unnatural position. Walls should be at least 6 ft. 6 in. high. Corrugated iron is fairly commonly used for roofing, but when used alone it is not satisfactory as it is readily affected by heat and cold, with the result that a sty with this type of roof is too hot in summer and too cold in winter. Corrugated iron along with straw thatch makes quite a good roof. Generally speaking, well constructed cattle boxes, especially those with exercise yards, ordinary covered yards, or partly covered yards such as are common in the north-east of Scotland, can be utilised to form suitable accommodation for pigs.

Fresh air, sunshine, and protection from extremes of heat and cold, together with sanitary floor conditions and facilities for exercise in the open air, go far to secure keen appetites, good digestion, the maintenance of sound health, and freedom from tuberculosis and other diseases.

**Shelters for Open Air Pig-Keeping.**—Since open air pig-keeping became widely practised, many different types of shelters have been devised. Where the system involves permanent enclosures, the shelters usually take the form of stoutly made wooden huts, of a more or less permanent character. In constructing these wooden huts, the general principles already outlined should be applied. When wood can be obtained cheaply, an economical and satisfactory roof can be made with wood and felt.



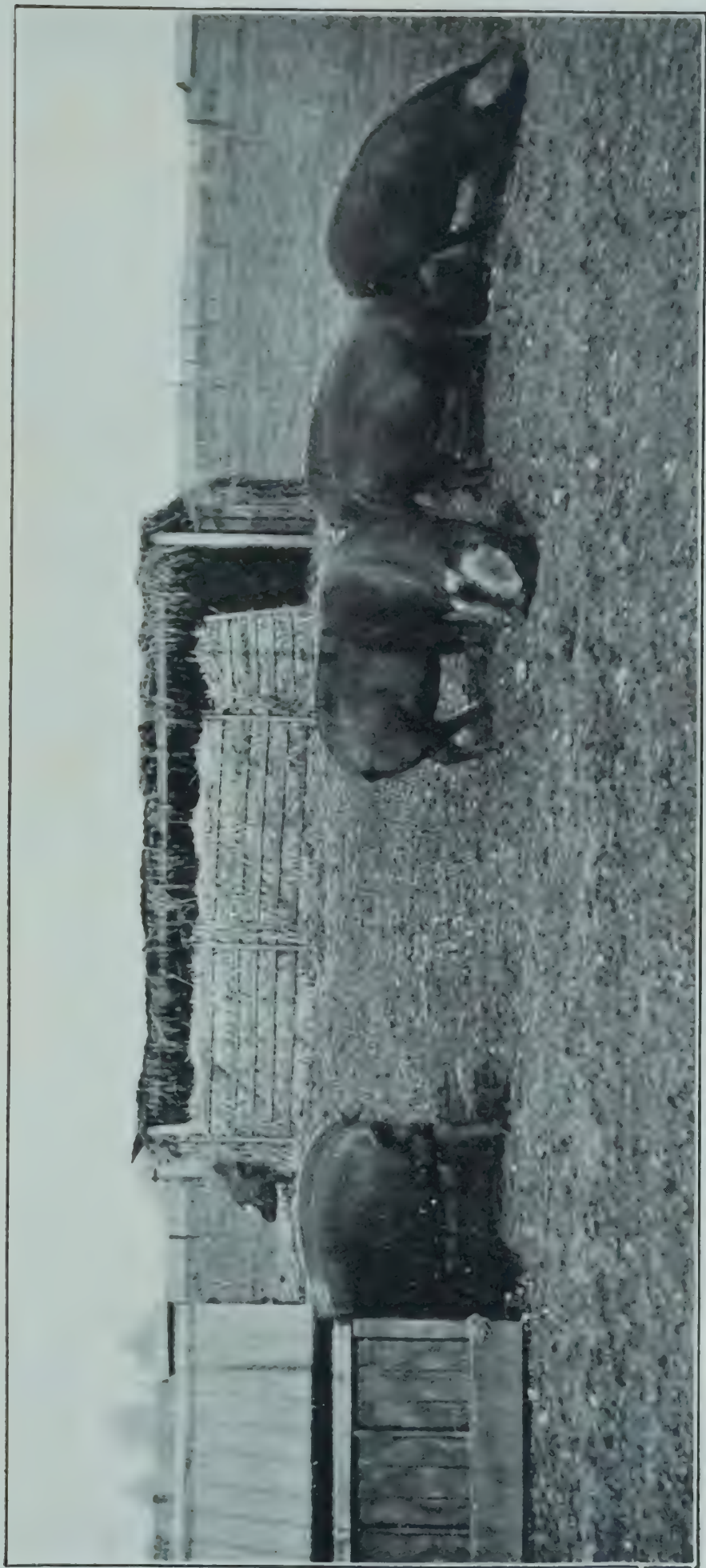


FIG. 1.—The first type of Pig Shelter used on the Northamptonshire Experimental Farm, Moulton.

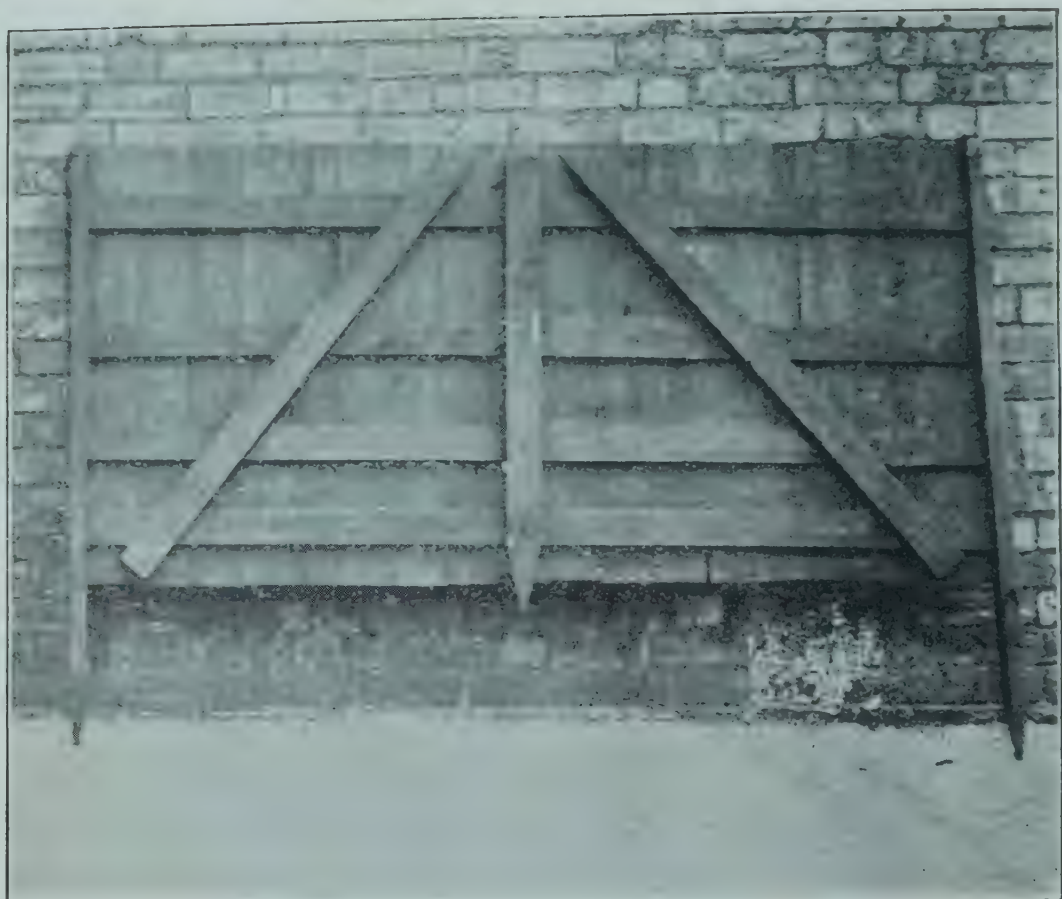


FIG. 2.—Boarded Hurdle used for making Shelters.

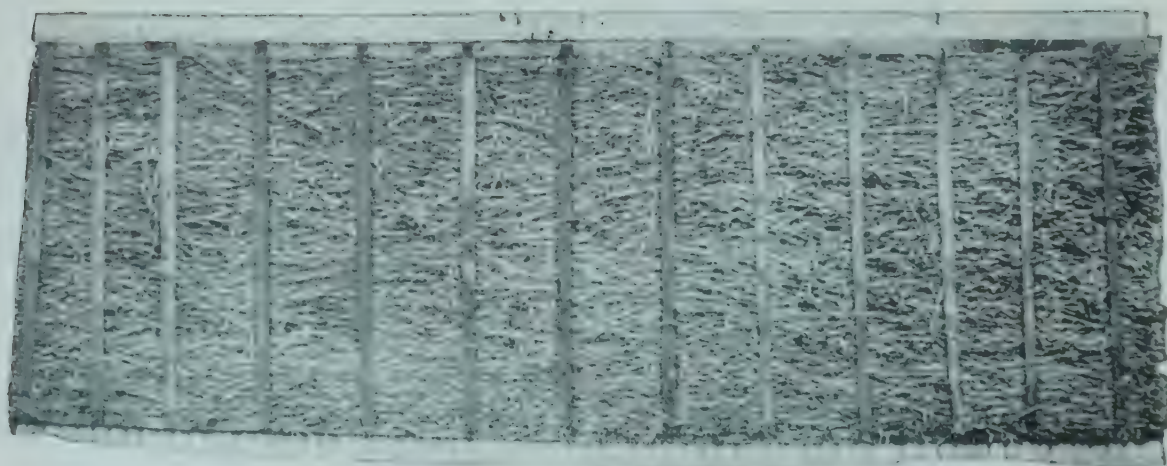


FIG. 3.—A Shelter Roof made of corrugated iron sheets thatched with straw on the under side.



For a system of management such as that practised on the Moulton Experimental Farm, movable shelters are much more useful than permanent and stationary huts. These movable shelters permit the practice of an elastic policy, whereby it is possible to run the pigs where they can be most profitably employed at any particular time. It may be to utilise arable land crops, to glean and clean the stubbles, or, if at any time arable land crops are not available, the shelters and the pigs can, with little expenditure of time and labour, be moved on to grass land. Our first type of shelter was made with thatched hurdles for the sides, back and front; and a roof consisting of corrugated iron thatched with straw underneath and fixed to two cross beams by means of bolts and nuts. Posts were used to support the roof in front, and at the back it was fixed to the tops of the hurdles.

Fig. 1 illustrates a rather roughly made shelter of this type. The gilts shown in the photograph lived in this shelter during the whole of the winter of 1922-23, on land where a crop of potatoes had been grown in the 1922 season. The potatoes had not been gleaned by hand and the gilts, fourteen in number, were penned on areas of about an acre at a time. They cleaned up the potatoes very effectively; practically none could be seen growing in the subsequent barley crop. On a ration of 4 lb. of dry meal per head per day together with the potatoes, they developed nice condition. This type of shelter, however, is not altogether satisfactory. The straw gets pulled out by the pigs and the hurdles require to be re-stuffed from time to time. Stuffed hurdles are not handy to move and they have now been abandoned in favour of wooden boarded hurdles of the kind shown in Fig. 2. The smaller size is used for the sides and back of the shelter and the higher size for the front. The smaller size is 6 ft. long, 3 ft. deep and the heads are 4 ft. high. The bigger size is 7 ft. long, 3 ft. 3 in. deep and the heads 4 ft. 6 in. high. Three-quarter-inch tongued boarding, 4½ in. wide, is used.

A thatched roof is shown separately in Fig. 3, to illustrate the method of thatching on the underside. The sheets of corrugated iron employed to make the roof are 2 ft. wide, by 7 ft. long. Bolts of various lengths are used to fasten the iron sheets to the two cross beams. The thatch is supported by narrow wooden bars which are usually obtained from old or broken hurdles.

For heavy land conditions, a shelter like that shown in Fig. 4, made with wooden hurdles and a one-piece roof, can be recom-

mended; but for moderately dry and light land, a shelter on wheels or runners is a great convenience on account of the ease with which it can be moved. Wheels add considerably to the cost and it is doubtful whether they are necessary. Wooden runners or skids, preferably shod with iron, have been found satisfactory. A shelter of this type can be moved by yoking one horse to it. It provides a simple solution of the labour difficulty involved when frequent changes of position are required. In securing uniform grazing and uniform distribution of manure, particularly when pigs are folded on arable land, it is essential that the shelter should be moved frequently. A further advantage in its favour is that its position can be altered without difficulty whenever necessary in order to secure the most favourable exposure to afford protection from wind or rain, or in very hot weather to obtain the maximum shade from the sun.

The shelter shown in Fig. 5 has the following dimensions:—Length 8 ft., width 6 ft. 6 in., height 4 ft. at the front and 2 ft. 9 in. at the back. The floor is of 1-in. elm boards on two 6-in. by 2-in. oak skids. Sides, front and back are of  $\frac{3}{4}$ -in. tongued boarding; roof of  $\frac{3}{4}$ -in. square edge boarding covered with sanded felt; upright posts 3 in. by 3 in.; doorway 2 ft. wide. A hinged door which opens outwards and downwards forms a platform for the pigs to walk on when going out and in. A farrowing rail is provided when required.

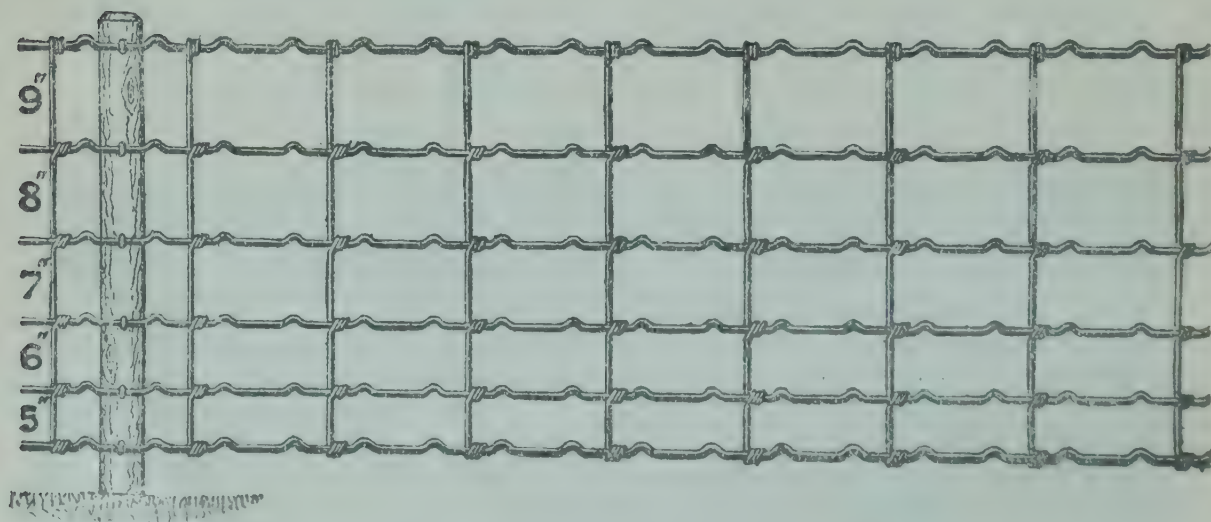


FIG. 6.—Light type of Fencing.

**Fencing.**—Several inquiries have been received recently as to the most economical form of fencing. At current prices we favour a make of wire which is offered at 5½d. per yard in 55-yard rolls. This fencing (see Fig. 6) is 35 in. high with verticals 12 in. apart. There are six horizontals, which are





FIG. 4.—Second type of Shelter used on the Northamptonshire Experimental Farm.  
Boarded Hurdles replace Thatched Hurdles.

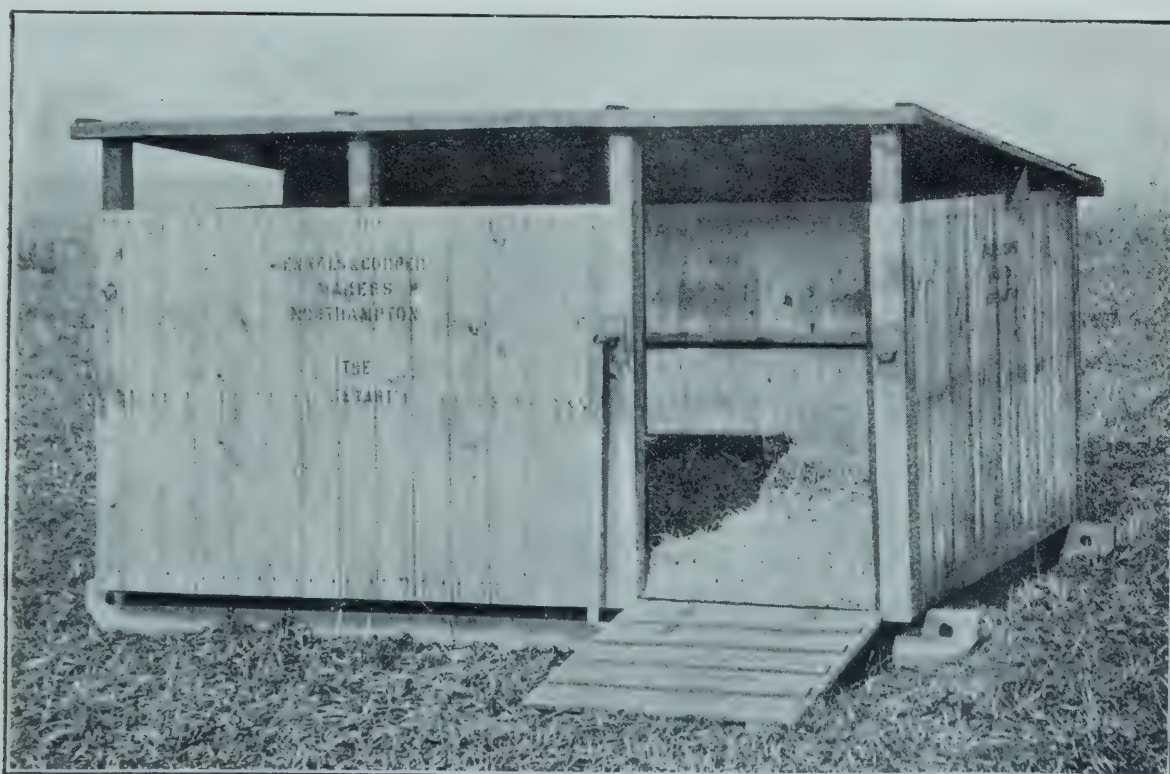


FIG. 5.—A Moveable Shelter on Runners in use on the Northamptonshire  
Experimental Farm.

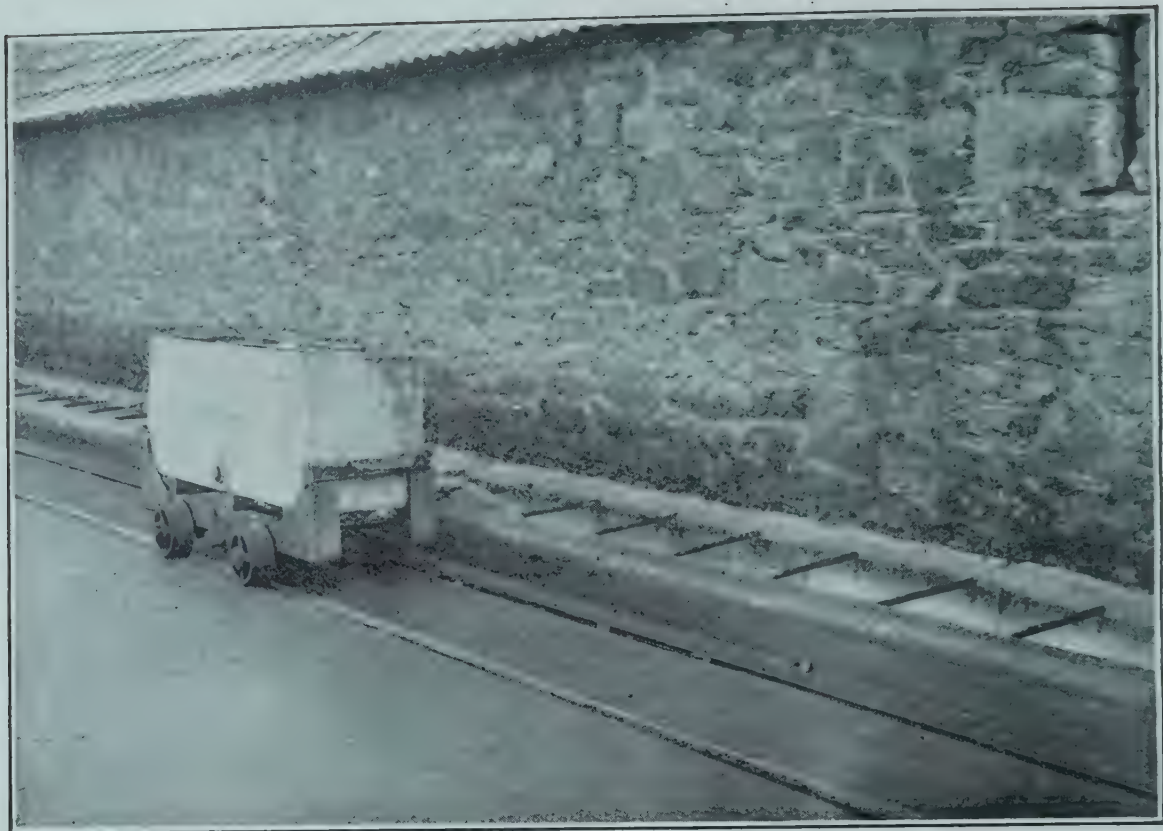


FIG. 8.—Feeding Trough, and Trolley on rails for conveying the food.



FIG. 9.—Weighing House and Loading Dock.



5 in. apart at the bottom and 9 in. apart at the top; the intermediate horizontals being 6 in., 7 in., and 8 in. apart, widening from the bottom upwards.

A heavier type of wire with verticals 6 in. apart, and 8 horizontals 3 in. apart at the bottom widening to 6 in. apart at the top, is being offered at 8½d. per yard. This class of wire (Fig. 7) is considerably stronger, and the smaller mesh is an advantage for fencing in small pigs, but for most classes of pigs used to outdoor conditions, the cheaper type of wire is satisfactory, particularly for arable land fencing. A strand of barbed wire along the ground is sometimes recommended, but this should not be necessary except for very troublesome pigs. Both types of wire are sold in two weights; the lighter weight is found sufficiently strong.

Stakes are required at intervals of four yards. Home-made stakes 3 in. by 3 in. and 4 ft. 6 in. long, obtained from wood felled on the farm, are used on the Experimental Farm. The stakes are cut out with a small power-driven circular saw 24 in. in diameter, which was installed in 1922 at a cost of £15 and which has proved a very economical purchase. The power for driving the saw is provided by the engine which is also used to drive the grinding mill and root pulper. It is very important to get the wire stretched tight before fixing it to the stakes. A useful wire strainer for this purpose is sold by most agricultural implement dealers at a reasonable cost.

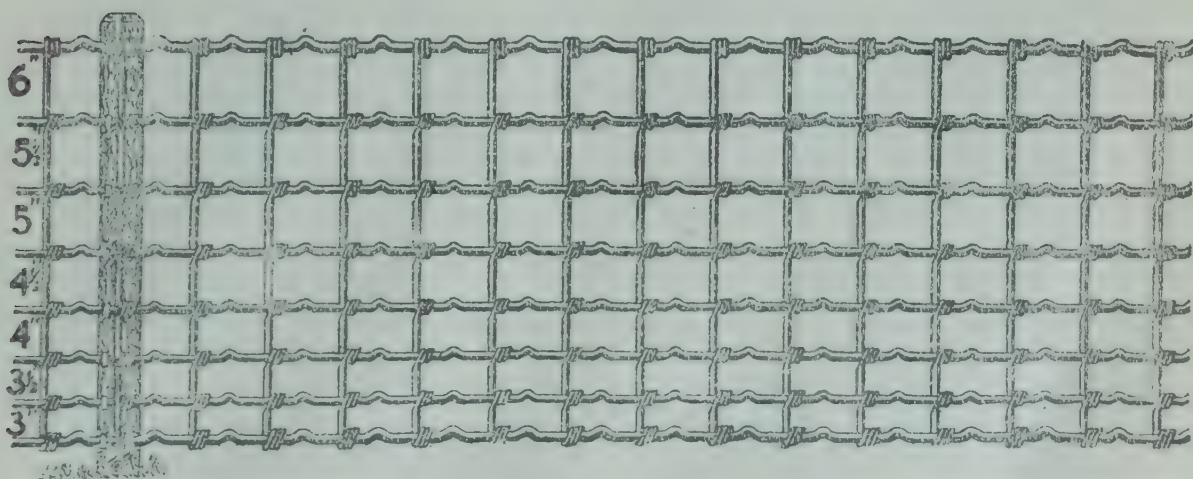


FIG. 7.—Heavier type of Fencing.

**General.**—In the general laying out of pig pens, the importance of making use of existing hard roads for carting feeding stuffs or water should be kept in view. The more convenient the pens are to the central feeding house, the less labour will

be required in feeding. If pens can be so arranged that a stream or other water supply is utilised so that pigs find their own drinking water. it will still further economise labour, especially where dry feeding is practised. Fig. 8 shows a feeding trough in a yard on Lord Bledisloe's Cross Farm, Lydney. The trolley on rails is used to convey the food from the feeding house to the troughs. The importance of having a weighbridge on the farm cannot be overestimated. An ordinary spring balance weighing up to 550 lb. and crate will be found very useful. Fig. 9 shows a combined loading dock and weighing house on Lord Bledisloe's farm.

In concluding this series of articles written at the request of the Ministry, I wish to express my grateful thanks to my colleagues, Mr. W. R. Seward and Miss J. W. Strang, for the assistance which they have given to me.

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## DAIRY FARMING IN HOLLAND.

E. HATFIELD,

*Ministry of Agriculture and Fisheries.*

THE greater portion of Holland's milk is produced on small farms, *i.e.*, farms of from 5 to 30 acres. Farms of 60 acres are considered large, and are by no means common. Rents vary from about £3 10s. to £6 per acre, including tax. The breed of cattle kept is the Friesian, either black-and-white or red-and-white, the former predominating. The cost of dairy cows 2½ years old ranges from £28 to £33, and the average annual yield of a cow in full milk is about 1,000 gallons. Young cows with first calf give less than this quantity, but taking the figures given at one of the factories—which must be accepted as being approximate, at any rate as to the number of cows—the yearly average yield from the 3,000 cows producing milk for this factory is 800 gallons per cow.

The average fat content of the milk supplied to the factories is around 3·3 per cent., although in Friesland it is reported that many herds produce milk with a fat percentage of 3·75 per cent. or higher.

Some of the factories render good service to their members by taking frequent samples of the milk from each cow from which milk is supplied, and the information thus obtained, in



conjunction with the records kept of the quantity of milk given, forms a very useful guide to the farmer in weeding out unprofitable cows. The various Cattle-Herdbook Associations are responsible for carrying on propaganda work, as well as the supervision of milk recording, and for ensuring that animals entered in the herdbooks are not only bred for producing a high quantity and quality of milk, but are also symmetrical in form and fully developed in body. One very interesting activity of the Herdbook Associations, and the Association of Co-operative Dairy Factories in Friesland, is what is known as a "Sanitary Service" for cattle in Friesland. This Sanitary Service is always on the look out for sick animals, in order to remove them from the herd, and also endeavours to secure a healthy system of rearing young cattle. It pays special attention to tuberculosis and abortion, and regularly examines the herds of the members for the detection of these diseases. All animals causing danger to the herd are removed and killed.

A special pamphlet has been written in English on "The Original Breed of Friesian Cattle" and can be obtained from The Friesian Society of Agriculture, Landbouwhuis, 11, Wiltenaskade, Leeuwarden, Holland.

**Dairy Factories.**—The factory system is fast replacing the manufacture of dairy products in the farmhouse, and at present there are no fewer than 960 dairies in Holland, 686 of them being co-operative, and the remainder proprietary. The growth of the factory system has been encouraged (1) by the law that all milk shall be pasteurised before being sold for consumption, (2) owing to the large number of very small holders that exist, and (3) by the fact that a large proportion of produce is exported.

The co-operative factories seen by the writer were well designed and well equipped, particularly those of more recent construction.

When an association of farmers desires to establish a co-operative factory, the Land Bank is approached for a loan to cover the cost of construction and equipment, this amount being guaranteed by each and every member of the proposed factory. In this way membership does not involve direct capital outlay, but each member must guarantee to pay his share of liabilities, up to any amount, if that is necessary. He must also bind himself to deliver all the milk of his cows for handling at the factory, and in some cases he is liable to a fine of five guilders per 1,000 litres (8s. 4d. per 222 gallons) in respect of the quantity of milk he has supplied to the factory during the 4 years

immediately preceding, if his supply is withdrawn without the consent of the Directors.

The milk is usually bought and paid for on the butterfat basis. In a purely butter-making factory the price paid is  $7\frac{1}{2}$  to 8 cents per litre (6·75d. to 7·2d. per gallon) in winter, and  $4\frac{1}{2}$  cents per litre (4·05d. per gallon) in summer, and in addition the farmers receive their quota of separated milk and buttermilk free. In cases where milk is purchased by factories for disposal as liquid milk, the price paid is 11 cents per litre (9·9d. per gallon) in winter, and 7 cents per litre (6·3d. per gallon) in summer.

For separating, the milk is heated to a temperature of  $30^{\circ}$  C. ( $86^{\circ}$  F.), the cream being further pasteurised to a temperature of  $83^{\circ}$  C. ( $181^{\circ}$  F.), and then cooled to  $13^{\circ}$  C. ( $55^{\circ}$  F.), before starter is added.

Many of the factories make cheese, as well as butter.

At one of the most up-to-date factories, where this system is in vogue, the milk is received twice daily. The receiving platform is open, and equipped with a weighing machine on each of three sides. From the weighing machines—which are of the dial type and Danish manufacture—the milk is run into a receiving tank, from which it is pumped over a water cooler, and afterwards run by gravitation into jacketted vats, where it is left for a given period—usually about 12 hours—in order to allow the cream to rise. The lower layer, of partially skimmed milk is run off and made into cheese, whilst the cream, or upper portion, is pasteurised, ripened, and made into butter.

The skim milk is made into Edam and Gouda cheeses, which are quickly made, the time taken between renneting the milk and putting the curd into moulds being from 2 to  $2\frac{1}{2}$  hours. When the curd has been in the moulds for from  $\frac{1}{4}$  to  $\frac{1}{2}$  an hour, it is turned, then left for 2 hours more, and afterwards put under pressure for 3 hours. When taken from the press the cheeses are trimmed, and placed in brine for 3 or 4 days. The brine, which is contained in large cement brining tanks, is kept circulating and cool by being pumped over a water cooler. In some cases the cheeses are coloured and waxed at the factory, but usually this is done by the Marketing Association. At this factory the whey is pumped into large tanks at the top of the building from which it is run through a separator to abstract the butterfat. The whey cream thus obtained is pasteurised and made into butter. Whey separation does not appear to be the general practice in Holland.



There does not appear to be provision at the factories for sterilising the milk churns, probably because the whey and separated milk are usually returned in the cans used for bringing new milk to the factory.

The farmers utilise the separated milk and whey for calf rearing and pig feeding. The German type of pig is usually kept, although it was stated that it is not very popular with the slaughterers.

**Combination of Co-operative Dairies.**—The next step in the co-operative structure is the combination of a number of co-operative factories, either for the purchase of their requirements, or the disposal of their produce. At Leeuwarden were seen four distinct examples of the way in which various co-operative dairies in Friesland amalgamate for (1) retailing milk, (2) dealing with surplus milk, (3) manufacturing dairy requirements, and (4) marketing cheese, butter and cream.

(1) *The Co-operative Steam Dairy* at Leeuwarden deals with 3,000 gallons of milk per day, some of which is pasteurised and sold as liquid milk. The remainder is separated, a portion of the cream being sold and the rest made into butter. The separated milk has such a proportion of cream added to it as will make a 20 per cent. or 10 per cent. Edam cheese, in accordance with the market demands. Another product at this factory is buttermilk soup, made by boiling pearl barley in the buttermilk. This is put up for sale in sterilized, stoppered, glass bottles.

This dairy sells the bulk of its products retail in the town of Leeuwarden. The whey, and as much of the buttermilk as is not made into soup, are returned to the affiliated factories or sold to local pigfeeders.

It is interesting to note that at this factory all the cheese moulds are periodically sterilized with live steam in a special chamber.

The price paid to the affiliated farmers' factories for milk is 11 cents per litre (9·9d. per gallon), and the retail price is 15 cents per litre (13·5d. per gallon).

(2) *The Co-operative Milk Products Factory* at Leeuwarden is owned by 45 farmers' co-operative factories for the purpose of dealing with the surplus milk of these factories. The amount of milk dealt with is about 22,000,000 litres (nearly 5,000,000 gallons) per annum. The price paid for the milk varies with the current price of cheese, and any profits available at the end of

the year are distributed among the affiliated factories in proportion to the amount of milk supplied by them.

The milk is made into sweetened and unsweetened condensed and evaporated milks for sale in Holland, as well as for export. The evaporated milk is condensed to half bulk, and then homogenised before being put into hermetically sealed tins. All tin containers are made on the premises, the maximum output being 70,000 tins per day. All the boxes required for packages are also made up on the premises.

Each affiliated factory agrees to send at least one-tenth of its total supply to the condensery for a certain portion of the year.

(3) *The Co-operative Rennet and Dairy Requirements Factory* at Leeuwarden is owned by 70 farmers' co-operative factories. It manufactures rennet, paraffin wax, colouring, lime soap, and other dairy requisites for sale to the affiliated factories and others.

(4) *The Friesche Co-operative Zuivel-Export Vereeniging Leeuwarden—Nederland*, was established in 1898 for the purpose of selling the milk products of the farmers' co-operative creameries, which are members of the Export Association.

At its large warehouses in Leeuwarden, the Association provides storage accommodation for 1,500 tons of cheese and 40,000 casks of butter. All cheese and butter is sold subject to inspection by the Government and the Friesian Co-operative Creameries' Control Institutes. The cheese may be made from full milk and contain not less than 48 per cent. of butterfat, or halfmilk containing not less than 30 per cent. of butterfat.

The store rooms for cheese are all served by a cold air duct, so that the temperature can be regulated even in the hottest weather. The butter store is kept at a temperature of 5° to 8° C.

When cheeses are required for export to the tropics, they are tested and tried out by being placed in a room kept at a high temperature, before being coloured and waxed ready for dispatch. Cheese and butter are also prepared for export by being put up in sterilized tins, which are hermetically sealed after filling.

Cheshire and Edam cheeses are treated by being immersed in paraffin wax heated to a temperature of 120° C., to reduce the loss by evaporation.

Affiliated factories forward consignments of cheese or butter to the store each week, thus preventing congestion in their own stores. The Marketing and Exporting Society has the right to instruct the factories to manufacture any type of cheese that may be required to meet the market demands, for the time being.



**The General Netherlands Dairy Association.**—The majority of the co-operative dairies are members of this Association. Its objects are to improve the quality of the produce of the factories by means of weekly competitions, by holding courses for the dairy staffs, by yearly examinations to test the efficiency of aspirants for the positions of assistant manager, butter-maker, cheese-maker, engineer and milk inspector respectively, as well as by giving advice and assistance with the building and equipment of new factories. It also purchases such requirements as coal, oil, packing materials, milk testers, etc., for the joint account of the federated associations.

The association concerns itself with collecting detailed statistics of the administration and work of the associated factories, as well as with publishing a weekly paper for the general propaganda of co-operative dairy work.

**Butter and Cheese Control Laboratories.**—The various butter and cheese control stations do not receive any financial assistance from the Government, although their operations are always under the strict supervision of Government officials.

Butter control was established in 1901 and in order to guarantee the purity of Netherlands butter a Government mark has been introduced. This Government mark is only placed on the butter made in dairies which are under the strict supervision of one of the seven butter control stations. It not only guarantees purity but also that the butter does not contain more than 16 per cent. of moisture.

Cheese control was established in 1907, and, as with butter, a Government mark is issued for each of the 4 standards of quality of cheese produced, namely—

\* Full-cream cheese containing not less than 45% butterfat.

Part	"	"	"	"	"	"	40%	"
"	"	"	"	"	"	"	30%	"
"	"	"	"	"	"	"	23%	"

The control mark for full cream cheese consists of a red transparent piece of casein with the Dutch coat-of-arms, and an inscription at the back in blue.

The control mark for cheese other than full cream, consists of a round, uncoloured, transparent piece of casein with the figures 40+, 30+, or 20+, according to grade, in a black hexagon with inscription. These marks are pressed into the cheese whilst in the moulds, thus becoming a portion of the rind, so that they cannot be removed without being broken.

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¶\* Full-cream cheese denotes cheese made from whole milk, and part-cream cheese that which is made from partially skimmed milk.

Even if the disc is taken off, the figures, which are printed on the under side, will remain on the cheese.

The marks for both butter and cheese have also a letter mark, and are numbered consecutively, by which means, with the help of control registers, it is always possible to trace the place and date of manufacture, in the event of a complaint being lodged.

For milk there is a definite fixed standard of 2·8 per cent. of butterfat, but no standard for solids other than fat.

The control stations are run by committees of management, the majority of the members of which must be non-producers. Members must also be of good reputation, not be concerned with the manufacture of margarine, nor be interested in the butter or cheese trade—presumably as traders or factors.

One of the outstanding features of this control system is the incentive it gives for the constant and careful steps taken to control the quality of the produce at each stage of its manufacture, and subsequent handling. The co-operative factories, the marketing associations, the dairy associations, and the control stations, all possess well equipped laboratories and qualified dairy chemists.

The co-operative system, as developed in Holland, tends towards specialization—the farmer in milk production, the factory in the production of the best quality of milk-products, and the marketing associations in finding the best markets, and providing the goods required by those markets.

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## THE UTILISATION OF WASTE PRODUCTS IN AGRICULTURE.

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THE utilisation of industrial residues and waste products for agricultural purposes, as feeding stuffs or manures, and even for human food, was a subject that perforce attracted much attention during the late war both in allied countries and, especially, in Germany. Although many of the expedients adopted on both sides to eke out dwindling resources of feeding stuffs and manures were uneconomic, and therefore bound to disappear on the return of more normal conditions, some of the information gained was of permanent value even in time of peace. The whole subject has recently been exhaustively reviewed in a monograph by Prof. A.



Bruttini,\* who has collected a large amount of valuable information, derived from allied and from German sources.

Waste products can in certain cases be utilised for manurial purposes, for cattle feeding, or finally for human food. From the agricultural point of view it is the first two of these methods which are of special interest.

Many more waste products can be used as manures than as foodstuffs, for, apart from products possessing no animal-feeding value, many which do possess such value also contain substances harmful to animals, rendering them unsuitable as feeding stuffs. On the other hand, there are few waste materials which do not contain plant food, available or potential, or constituents capable of exerting a beneficial effect on the physical properties of the soil, and even when they also contain bodies inimical to plant growth, such harmful bodies are often destroyed after incorporation with the soil.

The economic utilisation of waste products in agriculture is mainly determined by their bulkiness and water content in relation to the amount of nutrient elements and organic matter they contain. The cost of transport, or of drying down, may be so high as to render the product, as finally used, more expensive than any of the recognised artificial manures, when the comparison is made on the unit value of the fertilising elements. The utilisation of many waste products thus depends on whether they are produced in close proximity to agricultural land, so that freight charges can be eliminated or reduced to a minimum.

**Sewage.**—There can be no doubt that under the conditions of modern civilisation, by far the biggest source of waste, from the point of view of agriculture and food production, is that entailed in sewage.

In rural districts unprovided with main drainage, a large part of the excretory products of the population may find its way back, sooner or later, to the land, but in urban and industrial areas enormous amounts of most valuable fertilising material are lost well-nigh irretrievably in the sewage effluents which are discharged directly into, or find their way ultimately to the sea. Considering the question of nitrogen alone, an adult man excretes on the average 16 grammes of this element per day, the quantities for a woman and a child

\* *Ramassage et Utilisation des Déchets et Résidus*, by Prof. Arturo Bruttini, published by the International Institute of Agriculture, Rome, 1922. To be obtained from the Ministry of Agriculture, 10, Whitehall Place, London, S.W. 1, price 20 Frs. An English Edition of this book under the title *Uses of Waste Materials*, has now been published by P. S. King & Son, price 12s. net.

being respectively 13 and 8 grammes. In the British Isles, with a population of over 45 million, of which roughly half are on main drainage systems, there are nearly 120,000 metric tons of nitrogen lost into the sea every year, equivalent to the nitrogen of 600,000 metric tons of sulphate of ammonia. Unfortunately, a large part of this nitrogen exists in sewage effluent as soluble compounds in a state of very high dilution. A small part of this nitrogen may be utilised on special sewage farms, but the greater part is inevitably lost. The use of straw filters for the recovery of this soluble nitrogen, which is discussed later (p. 916), presents too many practical difficulties to offer much hope of a general solution of the problem, and short of the discovery of a cheap chemical capable of precipitating nitric and ammoniacal nitrogen from very dilute solutions in an insoluble form—a very remote possibility from the chemical point of view—it appears as if this enormous loss of nitrogen into the sea is unavoidable.

A small, but in the aggregate, important proportion of the nitrogen in sewage is present in an insoluble form as sludge. The older processes of sewage purification give rise to a sludge, the solid matter of which contains only a very small percentage of nitrogen, so small as to render the sludge of little value as a manure. In recent years, however, a new method of purification has been developed, which results in a sludge known as "activated sewage sludge." This contains a much higher percentage of nitrogen and the other fertilising elements than the older sludges.

Trials have been carried out at Rothamsted\* with activated sludge, made at the Harpenden sewage works, of the following composition:—

*Composition of Dry Matter of Activated Sewage Sludge.*

<i>Type of Sludge</i>		<i>Total Nitrogen %</i>	<i>Organic Matter</i>	<i>Phosphoric Acid (P<sub>2</sub>O<sub>5</sub>)%</i>	<i>Potash (K<sub>2</sub>O)%</i>
Harpenden Activated	1. ...	4.93	62.05	2.86	0.28
" "	2. ...	5.94	73.30	3.00	0.43
" Slate bed †	... †	2.63	46.80	0.34	0.08

It will be seen that the activated sludges are markedly richer than the old type of slate bed sludge in all three essential fertilising constituents. Manurial trials with the activated sludges were carried out on hay, potatoes and barley. Generally speaking, the activated sludge gave good yields in

\* E. H. Richards and G. C. Sawyer, *Journ. Soc. Chem. Ind.*, 1922, 41, 62, T.  
 † For comparison.



comparison with sulphate of ammonia or farmyard manure applied to give equal weights of nitrogen to the plots. Activated sludge thus possesses a high manurial value in marked contrast with the old type of sewage sludges tested on the Rothamsted farm in past years.

It has been calculated that from the sewage of all the towns of the British Isles with a population of 100,000 or over, 1,800,000 tons of sludge are produced per annum, so that if this were all of the activated type, a by no means negligible amount of an apparently valuable organic manure would be made available for agriculture. The activation process of sewage purification is, however, only carried out in a few centres in this country, and even there on little more than an experimental scale. Until the process has been put on a sounder economic basis, both as regards the cost of activation and the drying of the sludge, it does not offer much immediate promise of becoming a source of benefit to the farmer.

It was mentioned above that roughly only half the population of this country is served by main drainage, and that the waste products of the other half may ultimately find their way back to the land. From the point of view of the agricultural utilisation of these waste products, however, there are great possibilities of improvement. Practically the whole of the agriculture of China is founded on the use of night soil as manure, and a very elaborate organisation has existed in that country from time immemorial for the collection and agricultural use of human waste products. It is estimated that in China nearly 130,000,000 tons of such products are used every year, representing over 800,000 tons of nitrogen; 250,000 tons of phosphoric acid and 300,000 tons of potash. The manurial utilisation of human waste products finds a more limited, but still extensive application in certain European countries, notably in Flanders—hence the name of “Flemish manure”—and in certain parts of France and Italy.

Although there is little possibility of such extensive development in this country, the subject merits careful consideration in view of the growing scarcity of animal manure. So far from being unhygienic, as it might at first sight appear, the manurial utilisation of human waste products, properly organised, would in many cases make for a distinct improvement in the sanitary conditions and general health of many of our villages, in which the frequent occurrence of epidemics is without doubt partly attributable to unhygienic methods of

sewage disposal. It is difficult to devise methods of general applicability, but rural authorities and estate owners could render a great public service by devoting serious attention to the special condition of their own districts with a view to the introduction of methods of sewage disposal which would be hygienic and at the same time not agriculturally wasteful.

**Town Refuse.**—Another type of domestic residue of some agricultural value is that obtained in urban districts, consisting of the refuse collected by the municipal and urban authorities from road sweepings and house refuse. This material is of course of a very varied nature, and contains much of no manurial value, but many of the larger towns and cities now have installations for treating and sorting this refuse. The crushed and sifted material is of distinctly promising value as a manure. It is unnecessary to devote space to the subject in this article as it has recently been specially dealt with in this *Journal*.<sup>\*</sup> Manurial trials of refuse in comparison with town stable manure are being carried out at Rothamsted this year.

**Sea Products.**—Turning next to natural organic products not of domestic origin, it is convenient first to consider those derived from the sea. As already pointed out, modern systems of sewage disposal result in the loss by discharge into the sea of enormous amounts of nitrogen, phosphorus, and potash. In the distant future the time will arrive when the present-day resources of those fertilising materials will be approaching exhaustion, and it is probable that when this is the case, the resources of the sea will have to be utilised. As far as the supply of nitrogen is concerned, the atmosphere is available as an alternative source, and without doubt, by the time that our supplies of combined nitrogen are exhausted, industrial processes for the fixation of atmospheric nitrogen will have been so far developed that they will be able to supply our needs. For potash and phosphates, however, the sea will probably then be the only alternative source. The potash and phosphates which find their way into the sea ultimately serve for the growth of the higher marine organisms, animal and vegetable, of which the most important representatives are fishes and seaweeds respectively.

**Seaweed.**—In the wet state seaweed is not very different in composition from farmyard manure, though it is somewhat poorer in phosphoric acid; its average percentage composition is : water,

<sup>\*</sup> November, 1922, p. 685; December, 1922, p. 838; December, 1923, p. 870.



70.80; organic matter, 13.25; nitrogen, 0.3-0.5; potash ( $K_2O$ ), 0.8-1.8; phosphoric acid ( $P_2O_5$ ), 0.02-0.17. Manurial trials carried out in Scotland and Ireland show that wet seaweed is almost as good as dung.\* Seaweed is extensively used as a manure in maritime districts both abroad and in this country.† In the coastal districts of Scotland and Ireland, and in the Channel and Scilly Islands, it is collected in large quantities and either applied directly to the land—with or without a preliminary fermentation—especially by potato growers; or it is worked up for its high content of potash and iodine either by lixiviation or by burning it and extracting the ash.

Thoroughly dried and powdered seaweed contains as much as 25 per cent. of muriate of potash, most of which can be readily extracted with water. When burnt, the dried material gives from 35-50 per cent. of ash with a potash content ( $K_2O$ ) of 36-42 per cent.

In Norway, France, Italy, and Japan seaweed is similarly used. It is, however, on the Pacific coast of North America that seaweed, or “kelp,” is most extensively used. There, several companies “harvest” the kelp on a commercial scale, and during the War the extraction of potash (and iodine) from kelp was greatly developed. The Bureau of Fertilisers has founded a special experimental station in California for the study of the utilisation of kelp.

*Fish Residues*, in the form of fish meal, or fish “guano,” are too well known as a fertiliser to need more than cursory notice here. It is worth while, however, to note that by the use of fish manure some of the nitrogen and phosphorus lost into the sea as sewage is regained for the land.

**Straw.**—Before dealing with waste products of purely industrial origin, mention must be made of the utilisation of straw. During the War the increased amount of cereals grown in allied countries resulted in the accumulation of large quantities of straw for which no practical use was available. A process was worked at Rothamsted by Hutchinson and Richards whereby straw can be fermented and converted into so-called “Artificial Farmyard Manure.” This product has given very good results in manurial field trials, and it appears to have great possibilities, especially in corn-growing districts, where straw is always plentiful and farmyard manure can only be

\* See *Trans. Highland and Agric. Soc.*, 1898, p. 118; *Jour. Dept. Agr. & Techn. Instr. for Ireland*, Jan., 1914.

† See this *Journal*, Sept., 1910, Vol. 17, p. 458; and Leaflet No. 254.

obtained in sufficient amount by keeping beasts primarily for treading down the straw into manure. The process is now being developed on a commercial scale. It is unnecessary to deal with it in detail here as it has already been described in this *Journal* by the authors of the process.\* Essentially the same process has been used for sewage purification,† and the conservation of the nitrogen of sewage. The effluent is allowed to flow slowly through a series of straw filters, and the fermentation of the straw can go on in the presence of the very low concentrations of nitrogen in the sewage; in actual practice 65 per cent. of the nitrogen was retained. The product after removal from the filter is allowed to go on fermenting for some time. The bulkiness of the straw, and the consequent large size of the installation (it is calculated that 2 lb. of straw are needed per person and per day) are such that the process would be inapplicable to large towns, but for small communities it has distinct possibilities.

**Industrial Waste Products.**—The various waste products of the slaughter house—dried blood, meat meal or “guano,” greaves, tankage, etc.—are all well established manures, and it is unnecessary to discuss their manurial value here. Finally there are the waste products of industrial processes to be considered. Among the organic materials comprised in these residues the following may be mentioned.

*Brewery and Distillery Residues.*—Brewers’ grains, if for any reason unsuitable for feeding, and spent hops, are of small direct manurial value, but if obtainable cheaply they can be composted into a manure of some value for its physical effects. Vinasse, the residue from distillation of spirits, is used for feeding purposes, but the vinasse of molasses is rich in potash, and is worked up commercially for the preparation of potash salts.

*Tannery Residues.*—Waste tan is liable to be harmful to plants if applied to the soil in a fresh condition owing to its content of tannin, and in any case it is of little direct manurial value. After composting for a year or more, however, it is a useful material for lightening the texture of the soil, and finds some application in horticulture for this purpose or for mulches and hot-beds. It is also used for mushroom culture. Hide parings and the sludge that settles out in the steeping vats, often contain appreciable amounts of nitrogen, and if obtainable

\* August, 1921. Vol. 28, p. 398.

† E. H. Richards and M. G. Weekes, *Proc. Inst. Civil Eng.*, Engineering Conference, 1921.



cheaply are of distinct manurial value, though on the slow acting side. The sludge is rich in lime and therefore valuable for its physical effect and for sour soils.

*Leather Waste*, on the other hand, is of little or no value as a manure if derived from tanned hides, as it breaks down in the soil only with extreme slowness. It can be improved by suitable chemical treatment, though this is not carried out to any important extent on a commercial scale. In 1917 a committee of the British Association studied the question of the utilisation of old army boots and it was found that by dry distillation a yield of 23-25 per cent. of crude sulphate of ammonia could be obtained. Soft leather scraps are in a different category. They are quite a useful manure, and are used in some market gardening districts, *e.g.*, in Worcestershire.

*Sugar Works Residues*.—In view of the establishment of the beet sugar industry in this country, the value of the residues of this industry merits consideration. The tops from the beet, the extracted pulp, and the molasses are all useful feeding stuffs, but the first two can also be used directly as manures, while molasses were used during the War, after suitable treatment, as a constituent of compound manures.

Spent animal charcoal is rich in phosphoric acid and also contains 1.5 to 2 per cent. of nitrogen; it is a useful manure, and has long been used as such on the Continent, especially in the neighbourhood of sugar works.

The calcareous sludge obtained from the filter presses is mainly useful as a source of lime, of which it contains about 20 per cent., together with  $\frac{1}{2}$  to 1 per cent. of phosphoric acid. It is a good material for improving the condition of stiff or sour soils.

*Oil Cakes*.—Oil cakes unsuitable for feeding, such as those of castor oil beans, bitter almonds, belladonna, mustard, contain 4-7 per cent. of nitrogen, and appreciable amounts of phosphoric acid and potash. If applied directly to the soil, this should be done some time before sowing, otherwise seedlings may suffer from fungus attacks. Alternatively, they may be composted.

*Wool and Silk Waste*—Wool waste or shoddy is a useful manure, containing about 5 per cent. of nitrogen. Satisfactory results have been obtained in experiments at Rothamsted.\* Silk waste is fairly rich in nitrogen (8-10 per cent.) but is rather slow in its action.

*Hair, Feathers, Hoof and Horn*.—These are all very rich in nitrogen (12-17 per cent.) but exceedingly slow in action. They

\* This *Journal*, March, 1918, p. 1087.

are only suitable for direct use in beds which are laid down for several years, as in vine houses; otherwise they need preliminary treatment to render their nitrogen more readily available.

Among inorganic residues of industrial processes, *flue dust* from blast furnaces was considerably exploited during the War as a source of potash, then so scarce.\* Similarly, flue dust from cement works is fairly rich in potash. A sample recently examined at Rothamsted (from a Swedish source) contained nearly 20 per cent. of potash.

A recent development which may assume considerable importance for greenhouse work is the manuring of plants by carbonic acid gas obtained by purification of exhaust gases from furnaces, etc., or from special generators. This idea originated in Germany, and extraordinary results are claimed from experiments carried out in that country. The method is now being tried by some hot-house growers in this country.

In this short article it has not been possible to give more than a cursory account of the more important aspects of the use of waste products in agriculture, more particularly for manurial purposes. The reader desirous of studying the subject in more detail is referred to Professor Bruttini's monograph. It is to be hoped that the stimulus given during the War to the study of this subject will not be wholly lost in time of peace, and that more attention will be paid to the question of preventing the loss of the incalculably large amounts of manurial elements in waste products of various origins, which occurs at the present time.

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## THE PREVENTION OF "BUNT" IN WHEAT.

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On previous occasions we have published in this *Journal*† the results of experiments in the prevention of "bunt" in wheat. These experiments have shown that formalin.‡ used at the

\* This *Journal*, February, 1915, p. 1053; August, 1917, p. 526.

† Vol. 27, p. 1013 (1921); vol. 29, p. 722 (1922).

‡ Formalin is the trade name for a 40 per cent. solution of the gas formaldehyde in water. Purchasers should obtain a guarantee that the formalin sold is of the above strength and should see that it is a clear solution free from any precipitate. Formalin needs to be kept in a tightly closed bottle, and only freshly prepared diluted solutions should be used, as the gas is volatile.



greatly diluted strength of 1 part of formalin to 480 parts of water (=1 pint formalin to 60 gal. water) and applied at the rate of 2 gal. of the diluted solution to the sack (of 4 bushels), entirely prevents " bunt," and, unlike the " pickling " method with " bluestone " (copper sulphate), does not appreciably affect the germination of the wheat. The formalin method is simple, negligible in cost, and the labour involved is not greater than that of the customary " pickling " process when " bluestone " is used. Objections have been raised against the formalin method of treatment on the ground that the volume of solution used wetted the grains so much that difficulty might be experienced in drilling the seed, although farmers who have actually employed the method find no difficulty in this connection. Laboratory experiments had shown that 2 gal. of solution to the sack was necessary to ensure the thorough wetting of the seed and was therefore recommended. It was realized, however, that a lower rate, if equally efficient, might be desirable; and the object of the experiments described below was to ascertain whether a smaller quantity of the formalin solution than 2 gal. to the sack would suffice. Experiments were therefore made during 1922-23 using the formalin solution at the rate of 2 gal.,  $1\frac{1}{2}$  gal., 1 gal. and  $\frac{1}{2}$  gal., respectively, to the sack. The seed wheat used was artificially contaminated with the " bunt " fungus, a large quantity of whole " bunted " grains being crushed in a mortar, and the mass of liberated *spores* being then well mixed into the heap of seed corn—enough spore-material being added to coat each grain and to darken its tuft of hairs. On taking out a handful of the contaminated seed corn, the palm of the hand became darkened with the spores of " bunt." As the results given below demonstrate, this method of contamination was entirely adequate, the untreated plots giving as high a percentage of " bunted " ears as 78. The comparative value of the differing quantities of formalin solution was therefore severely tested in a satisfactory manner.

**Description of the Experiments with Formalin.**—About two pints of " bunted " grains (obtained from the previous year's experimental plots) were crushed with a pestle and mortar and well mixed up with  $1\frac{1}{2}$  bushels of Red Standard seed wheat. Ten separate gallons of this contaminated seed were measured out, and five of them labelled A1, B1, C1, D1 and E1, respectively; to each of the other five gallons 90 c.c. (equivalent approximately to 2 per cent. by volume) of whole " bunted " grains were added, and these were labelled A2, B2, C2, D2 and E2, respectively.

The ten lots of contaminated seed were treated as follows, the solution used being 1 part of formalin in 480 parts of water (*i.e.*, at the rate of 1 pint formalin to 60 gallons of water):—

A1 and A2	each received	$\frac{1}{2}$ pint solution,	= 2 gal. per 4 bush.
B1    B2	"      "	$\frac{3}{8}$ "      "	= $1\frac{1}{2}$ "      "
C1    C2	"      "	$\frac{1}{4}$ "      "	= 1       "      "
D1    D2	"      "	$\frac{1}{8}$ "      "	= $\frac{1}{2}$ "      "
E1    E2	controls (untreated).		

The method of treatment adopted was as follows: each gallon of seed wheat was spread out on a slate slab, then sprinkled with the allotted volume of the solution and shovelled into a heap; the seed was then again spread out and shovelled up twice; when the heap was thus made a third time the wetting treatment was considered complete. Each lot was then covered with a sheet of cloth moistened with the diluted formalin solution and left for four hours; at the end of that time the seed was spread out to dry in a layer about 1 inch deep.

The seed was sown\* on the respective plots on 21st November, 1922, the day following treatment, the rate of seeding being about  $3\frac{1}{2}$  bushels to the acre. In order to reduce the chances of any re-contamination of the treated seed the plots were sown in the following order:—A1, B1, C1, D1 (at this stage the hands of the person sowing the seed were washed with the diluted formalin solution), A2, B2, C2, D2, E1, E2; the plots were then raked over in the same order.

Samples of the treated and untreated seed were sent to the Official Seed Testing Station on the day the plots were sown. The report received gave the percentage of germinating seed as follows:—

Volume of solution used to sack (4 bushels) of seed.	Sample.	Germination. Per cent.
2 gal.                   ...	A1                   ...	97
	A2                   ...	97
$1\frac{1}{2}$ gal.               ...	B1                   ...	97
	B2                   ...	97
1 gal.                   ...	C1                   ...	96
	C2                   ...	96
$\frac{1}{2}$ gal.               ...	D1                   ...	98
	D2                   ...	97
Untreated             ...	E1                   ...	96
	E2                   ...	98

The uniformity of the results shows that the treatment with the diluted formalin solution, even when used at the rate of 2 gal. per sack, does not adversely affect germination in laboratory tests.

\* As on previous occasions, Mr. P. Oglesby kindly sowed the plots by hand, and we desire to express our thanks for his assistance.



The relative positions of the ten plots are shown in the plan given in Fig. 1. A very good " plant " was obtained on all the plots. As the crops approached maturity, there was a striking contrast in the general appearance of the plots A1 and A2 and the control plots E1, E2, the plants of the former being taller and of a more healthy colour than those of the latter, which were obviously seriously affected in growth by the great prevalence of " bunt." In August, 1923, the crops were cut and made into sheaves in the usual way. Later, the sheaves were untied and a handful was taken from each so as to make one sheaf from each plot containing samples from various parts of the plot. The ten sheaves (*i.e.*, one from each plot) obtained in this way were carried to the laboratory; 1,000 ears (in ten lots of 100 each) were cut at random from each sheaf and the number of " bunted " ears present in each lot was ascertained.

The following Table gives the results obtained:—

*Table showing the Number of " bunted " ears per 1,000.*

Lots of 100 each.	A1. 2 gal.	B1. 1½ gal.	C1. 1 gal.	D1. ½ gal.	E1. Control (untreated).
1	1	3	19	65	81
2	1	0	25	80	89
3	0	1	20	78	78
4	0	0	9	61	68
5	0	1	11	79	71
6	0	0	9	73	88
7	0	1	20	78	78
8	0	0	23	62	77
9	0	0	19	39	80
10	0	5	13	54	76
1,000	2	11	168	669	786

Lots of 100 each.	A2		C2.	D2.	E2.
1	0	2	37	77	82
2	1	0	29	57	79
3	1	4	24	60	88
4	0	0	29	80	76
5	0	2	39	79	85
6	1	4	16	74	64
7	0	0	26	64	76
8	0	0	13	55	75
9	0	1	20	66	82
10	1	1	35	54	76
1,000	4	14	268	666	783

It will be seen that the plots, the seed for which had received the same treatment (A1, A2; B1, B2, etc.), agree very closely

as regards the numbers of “ bunted ” ears, with the exception of C1 and C2. On the whole, however, it appears that the presence of the 2 per cent. of “ bunted ” grains added to the seed did not materially affect the result of the treatments, and the pairs of plots may therefore be considered as duplicates in estimating the percentage of “ bunt,” as given in the following Table :—

<i>Plots.</i>		<i>Rate at which the formalin solution was used.</i>		<i>Average of “ bunted ” ears, per cent.</i>
A1, A2	...	2 gal. per sack (4 bush.)	...	0·30
B1, B2	...	1½ ” ” ” ”	...	1·25
C1, C2	...	1 ” ” ” ”	...	21·80
D1, D2	...	½ ” ” ” ”	...	66·75
E1, E2	...	untreated (control)	...	78·45

A1		B2
B1		A2
E1		E2
C1		D2
D1		C2

FIG. 1.—Showing position of the Plots.

It is clearly shown by the above figures that the amount of liquid required to disinfect properly each grain in a sack (4 bush.) of wheat, by the method adopted and described above, is 2 gal., the amount mentioned in our previous communications. Using 1½ gal. to the sack a very fair control of “ bunt ” is obtained, but used at the rate of 1 gal. to the sack the amount of liquid is clearly insufficient to disinfect properly each grain, with the result that over 21 per cent. of ears may become “ bunted.” It is reasonable to suppose from the figures obtained that the fungicidal action of the formalin solution is dependent upon the dissolved formaldehyde gas being brought by the water into close contact with the fungus *spores*.

Incidentally, the facts obtained suggest that where the “ traditional ” method of “ pickling ” wheat with copper sulphate



solution has been used by the farmer, in which only 1 gal. of the solution has been used to the sack (4 bush.), the results have been the escape of a large percentage of the grains from (1) disinfection of the " bunt " spores, and (2) death or injury to germination-capacity from the injurious effects of the copper sulphate solution on the grains.

**Formalin and Copper Sulphate Compared.**—The following field experiment, carried out on the College Farm at Wye, where formalin solution and copper sulphate solution were used, may be mentioned here.

The seed wheat (variety Yeoman) was treated on 9th November, 1922, some with formalin and some with copper sulphate, for direct comparison as to the effect on germination under field conditions. Three sacks of seed were dressed with formalin, diluted at the rate of 1 pint to 60 gal. of water, using 2 gal. per sack, and three sacks of the seed were dressed with copper sulphate dissolved at the rate of 1 lb. to 1 gal. of water, using 1 gal. of the solution to the sack.\*

The seed was spread out on a floor, sprinkled with the solution and then shovelled into a heap; it was spread out and again shovelled up twice; when spread out and made into a heap the third time the mixing was considered to be complete. In the case of the formalin-treated seed the heap was then covered with sacks (which had been soaked in the formalin solution), left for 4 hours and then spread out to dry. The seed treated with the copper sulphate solution was, on the other hand, spread out at once to dry. Owing to adverse weather conditions the seed was not sown until four days later (13th November). The field was divided into four plots; two were sown with the formalin-treated seed, the other two with the copper-sulphate-treated seed. The rate of seeding was  $3\frac{1}{2}$  bushels to the acre. On the day of sowing samples were sent to the Official Seed Testing Station; the following report on the germination was received, the figures giving the percentage of germinated seeds.†

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\* This is the " pickling " method in common use in this country.

† Mr. C. B. Saunders, of the Official Seed Testing Station, commented on the results as follows:—" Your numbers 1 and 2, *i.e.*, the untreated and the formalin-treated, can be considered to have the same final germination, since the No. 2 might have reached 99 per cent. if we had left it on two days longer. It had germinated 97 per cent. on the fifth day, and we then discontinued the test. No. 1 did not reach 99 per cent. till the seventh day. This was in part due to the fact that one of the pots got rather dry, but apart from this I do not think it was as quick off the mark as your No. 2. The behaviour of No. 3 was quite different. It averaged 63 per cent. in five days, 73 per cent. in seven days, and went on germinating slowly till the eighteenth day, when we discontinued the test. It is possible that it might have done one or two per cent. more. We always find that copper sulphate retards germination."

		5 days.	7 days	11 days.	15 days.	18 days.
No. 1.	Untreated ...	88	99	—	—	—
No. 2.	Formalin-treated ...	97	—	—	—	—
No. 3.	Copper-sulphate-treated	63	76	81	87	90

Some of the seed was kept until 30th November (three weeks after treatment) when samples were again sent to the Seed Testing Station.

The report showed the germination to be as follows :—

		5 days.	6 days.	7 days.	10 days.	12 days.	14 days.
No. 1	...	96	98	—	—	—	—
No. 2	...	97	—	—	—	—	—
No. 3	...	67	—	77	84	87	92

On 14th December the field was examined; the plants from the formalin-treated seed were about  $1\frac{1}{2}$  in. high and it was estimated that, in appearance, they were 3 or 4 days ahead in growth compared with those from the copper-sulphate-treated seed. This difference in growth was maintained for some weeks, but ultimately the plots were indistinguishable as regards growth. Equal portions of the differently treated plots were harvested and thrashed separately; but no appreciable difference in yield was found.

The points of interest in the above field experiment are the delayed germination of the seed treated by " pickling " with copper sulphate, and the corresponding retardation of the appearance of the young plants above ground, thus lengthening the critical period when the seed is liable to attack by birds and other enemies. In this particular case the copper sulphate delayed germination and killed from 6 to 9 per cent. of the seeds. Cases have come to our notice\* where the damage caused by the copper sulphate treatment has been considerably greater than this, 40 per cent. of the seed having been killed; and these facts suggest that high rates of seeding, to compensate for this damage, may have become customary.

**Summary.**—The following method of treatment is a certain preventive against " bunt " in wheat, and does not injure the germination of the seed, so that no increase in the proper rate of seeding is necessary :—

- (1) The seed in a heap is sprinkled with diluted formalin solution (1 pint formalin in 60 gal. water = 1 fluid oz. to 3 gal. water). *Two gallons of the solution must be used to every sack (4 bushels) of wheat.* The seed is shovelled over and over until all the grains are wetted; the solution must not be allowed to form pools under the heap in which the grains might soak.

\* See this *Journal*, Vol. XXVII, Feb., 1921, p. 1016.



- (2) The heap of wetted seeds is covered over *for four hours*, not longer, with sacks which have been soaked in the diluted solution ; the sacks should be uniformly wet but not dripping.
- (3) The heap is then spread out to dry in a thin layer on a clean floor. If the floor has previously been used for untreated wheat it should be wetted all over with the diluted formalin solution and allowed to dry before the treated seed is spread on it.
- (4) Precaution must be taken *to prevent the re-contamination* of the treated seed, *e.g.*, sacks which have held untreated contaminated wheat must not be used for the treated seed unless they have been soaked in the diluted formalin solution or boiled in water.
- (5) The treated seed when dry should be sown *as soon as possible*.

The above method is as easy to use as the old "pickling" method with bluestone, it is also cheaper.\*

At the present time (at any rate in the south of England) something like 50 per cent. of the samples of English wheat on the market are contaminated with "bunt." A certain, simple and safe remedy against "bunt" is now available in the diluted formalin treatment. When all farmers use it, English wheat will be clean.

\* \* \* \* \*

## THE COMMON CAUSE OF FAILURE OF SPRING OATS—FRIT FLY.

F. R. PETHERBRIDGE, M.A.,  
*School of Agriculture, Cambridge.*

MANY farmers will remember the year 1922 as a particularly bad season for spring oats. April of that year was very cold and, as a consequence, oats made very little growth by the beginning of May.

Previous observations have shown that spring oats which have not made good growth before the first week in May usually suffer badly from attacks of the frit fly maggot. This occurred in 1922, when, as a result of frit fly attack, the average yield per acre in the eastern counties was probably well under four quarters. In addition many fields were ploughed up, and some fields which were undersown were cut for hay. The bushel weight was also very low owing to the attack of the second brood of maggots. One sample of oats from Norfolk examined by the writer contained nearly 60 per cent. of empty "seeds," the grain (or kernel) having been eaten by the frit fly maggot. This sample weighed under 24 lb. per bushel.

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\* The cost of material for treating a sack of wheat, with formalin at 2s. 6d. a pint, is 1d.

The oats on the University Farm sown on 16th and 17th March on strong soil in good condition gave the following results :—

<i>Oat Variety Trials, 1922.</i>								
<i>Variety.</i>	<i>Strength of Straw.</i>			<i>Sacks Head at</i>	<i>Sacks Tail at</i>	<i>Total Grain</i>	<i>Total Straw</i>	<i>Bushel weight.</i>
				<i>168 lb.</i>	<i>168 lb.</i>	<i>Sacks.</i>	<i>cwt.</i>	<i>lb.</i>
Supreme ...	Short, moderate			8.8	0.92	9.7	23.1	31
Yielder ...	Poor ...			10.0	1.37	11.4	33.4	30
Bountiful ...	Good ...			7.35	1.11	8.5	34.2	31
New Abundance	Poor ...			9.93	1.47	11.4	35.2	30
Victory ...	Good ...			8.8	1.60	10.4	36.0	33
Castleton Potato	Good ...			5.7	2.1	7.8	42.1	31
Black Tartarian	Good ...			5.3	2.2	7.5	31.6	28

This indicates that both poor tillerers like Black Tartarian, and extremely good tillerers like Castleton Potato, may suffer severely from attacks of the frit fly maggots.

**Experiment on Dates of Sowings.**—In 1923 an experiment was arranged to demonstrate that the date of sowing plays an extremely important part in determining the yield of spring oats. On a gravel field on the University Farm, plots measuring about one-twentieth of an acre were marked off. These received superphosphate 3 cwt. per acre, kainit 2 cwt. per acre, and the day before sowing each plot received sulphate of ammonia at the rate of  $1\frac{1}{4}$  cwt. per acre.

The variety used was New Abundance, the seed having been grown on the University Farm the previous year. The seed was sown by hand in furrows about a foot apart, drawn out with a hoe, and the soil then raked level.

*Plot 1* sown 1st February; soil in good condition. 3 bushels per acre. Plants showing through 23rd February.

*Plot 2* sown 20th February. (Too wet for sowing on the date arranged, 15th February.) Soil was rather wet for sowing on 20th February. 3 bushels per acre. Plants showing through 18th March.

*Plot 3* sown 1st March on a good tilth. 3 bushels per acre. Plants showing through 24th March.

*Plot 4* sown 15th March on a good tilth. 3 bushels per acre. Plants showing through 3rd April.

*Plot 5* sown 23rd March on a good tilth. 4 bushels per acre. Plants showing through 7th April.

*Plot 6* (Half plot). Sown 31st March on a good tilth. 4 bushels per acre. Plants showing through 12th April.

*Plot 7* (Half plot). Sown 14th April on a good tilth. 4 bushels per acre. Plants showing through 29th April.

**Results.**—As the season advanced it was obvious that the yields of the plots would show great differences. An examina-



tion of the plots on 12th May showed that the first three were almost free from frit fly eggs, whereas eggs were found on every plant examined in Plot 7. On the other plots the number of eggs were fewer as the age of the plants increased. A careful examination of the plots was made on 28th May to determine the extent of the frit damage.

*The earliest Plots (1, 2 and 3) showed only a very small percentage of attacked shoots, and most of these were damaged by wireworms or caterpillars. These plots showed very few late tillers.*

*Plot 4 showed a moderate attack, about one-third of the shoots being attacked.*

*Plot 5 showed a larger percentage of attack than Plot 4, but owing to the extra seeding (4 bushels per acre instead of 3 bushels) the number of healthy shoots was very similar.*

*On Plot 6 every plant was attacked, but a few healthy shoots were present on many of the plants. The number of ears was about 30 per cent. of those on Plot 1.*

*On Plot 7 every plant was badly attacked, and only a small percentage of healthy shoots remained. Most of the plants were badly stunted. The number of ears was about 10 per cent. of those on Plot 1.*

The following table shows the yield of straw and grain:—

	<i>Date of Sowing.</i>	<i>Yield per acre in cwt.</i>	
		<i>Grain.</i>	<i>Straw.</i>
<i>Seeded at 3 bushels per acre.</i>			
Plot 1	February 1st	16.0	42.7
„ 2	„ 20th	14.9	31.0
„ 3	March 1st	15.2	29.3
„ 4	„ 15th	10.7	25.1
<i>Seeded at 4 bushels per acre.</i>			
Plot 5	March 23rd	9.9	25.3
„ 6	„ 31st	6.2	18.1
„ 7	April 14th	2.0	8.8

These figures indicate that the date of sowing has a great effect on the yield of spring oats. The oats sown on 1st March, or earlier, gave a good yield for the type of land (gravel) on which they were grown; those sown later in March gave rather a poor yield, while those sown at the end of March and in April gave extremely unprofitable yields. It should also be noted that the yield of straw gets less as the date of sowing gets later. The plot sown on 1st February gave a particularly good yield of straw, whilst the yield of the plot sown last was extremely low. A slightly later sowing on a headland near by gave even poorer results.

The differences in yield due to date of sowing will vary with the season, and also according to the type of land, but on all soils, even the very best, in any year there is usually a big

difference between early-sown and late-sown spring oats. On many farms it is extremely difficult to get a tilth early in the season—in February and early March. In cases like these when spring oats cannot be sown early, it is probably more profitable to grow very few spring oats and to get these in at the first opportunity; but for the later sowings, to substitute some other crop, such as barley, which is not likely to suffer much from an attack of frit fly. Many farmers know that late-sown spring oats in the south of England are not an economic proposition, but there are still a large number who do not realise that indirectly the date of sowing of spring oats is one of the most important factors in determining the yield. Winter oats, when they are a good plant in April, do not suffer much from damage by frit fly except in very abnormal seasons. Like wheat, however, they may suffer badly from frit fly attack in February and March if they are sown after a ley containing grasses ploughed up after harvest. Acknowledgment is made to Mr. S. G. Jary for his assistance in making the above observations.

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## DODDER AND ITS REMOVAL FROM CLOVER SEED.

C. B. SAUNDERS.

IN this *Journal* for April, 1923, appeared an article, based on an inquiry made by the Ministry, on the "Prevalence of Dodder in Great Britain." The result of the inquiry, which dealt mainly with evidence from the field, showed that there was no apparent increase of dodder in this country. No distinction, however, was made between the different forms of dodder, and the present note, based on the records of the Official Seed Testing Station, is put forward in partial amplification of that article.

The Station records have been examined in so far as they relate to the occurrence of dodder in samples of red clover seed described as "English." The percentage of such samples found to contain dodder in the years 1917-18 to 1922-23 was respectively as follows:—

1917-18	...	24.0		1920-21	...	4.4
1918-19	...	12.1		1921-22	...	10.2
1919-20	...	3.4		1922-23	...	17.6

As might be expected, considerable fluctuation is shown, the presence of the seeds of dodder in commercial samples depending largely on the occurrence of climatic conditions favourable for the ripening of the seed.



The dodder found in red clover samples may for practical purposes be referred to two types—the small seeded form and the large seeded form. The first mentioned is the so-called “English Dodder” (*Cuscuta trifolii*, Bab.) which is indigenous and, under normal conditions, can ripen seed over the greater part of England south of a line from Hull to Liverpool. The term “large seeded dodder” is used to describe the non-indigenous species which occur generally in red clover of European and Chilian origin. These large seeded dodders include two or three closely allied species whose seeds are not easily distinguished from one another, and regarding whose nomenclature there is some difference of opinion. For the present purpose it will be convenient to describe them generally as forms of *Cuscuta racemosa*, Mart. The impression has been held in the past in certain quarters that the forms of *Cuscuta racemosa* do not ripen seed in this country or, at the most, only in exceptional circumstances. The fairly frequent occurrence of *Cuscuta racemosa* in samples sent to the Official Seed Testing Station as English-grown red clover has caused some doubt to be cast on the accuracy of this theory, and one practical object of this note is to draw attention to a fact which it is suggested is of economic importance.

The records of the Official Seed Testing Station show that in the last four years the percentage of samples described as English red clover which contained the large seeded dodder was 1.2, 2.2, 2.3, and 10.0 respectively. Figures for earlier years are not available. The occurrence of individual cases is easily explained by the fact that samples consisting wholly or in part of foreign seed are from time to time sent to the Station misdescribed as “English.” There is no evidence that misdescription of this nature is increasing; in fact the reverse is almost certainly the case, since seed legislation has resulted in greater care and accuracy.

A critical study of the records relating to the 36 samples of English red clover in which large seeded dodder was found at the Official Seed Testing Station during the past season suggests that, though some samples are almost certainly misdescribed, the majority are from bulks once-grown in England from foreign seed containing the dodder. (This practice of applying the description “English Red Clover” to once-grown foreign seed is a matter which demands consideration.)

It is suggested therefore that there is evidence that the forms of *Cuscuta racemosa* can produce seed in this country, and that

the figures given above hint at the possibility of the plant gradually acclimatising itself to English conditions by the automatic selection of hardier and early ripening strains. Further, it seems not improbable that, if due attention is not paid to the matter, this pest may become as troublesome in England as it is in some continental countries.

In view of this possibility it is of interest to note that a new process has recently been discovered by which the removal of the large seeded dodder from clover seed is easily effected. The small seeded dodder is only about 0.8 mm. in diameter and can therefore be comparatively easily screened out of red clover, without loss of good seed, by the use of a sieve having holes of 1 mm. diameter—a mesh almost equivalent to a number  $5\frac{1}{2}$  sieve. This separation therefore presents no difficulties to the seed cleaner.

On the other hand, *Cuscuta racemosa* is very similar in size to red clover, and consequently its removal has in the past been a matter of considerable difficulty even though the cleaner was prepared to face a considerable wastage of good seed, amounting sometimes in the case of Chilian seed to as much as 25 per cent. of the bulk. Such cleaning is laborious and expensive, and materially increases the price of “Dodder-free” seed.

It is worth while therefore to give a brief outline of the process referred to above, which will enable the cleaner to remove *Cuscuta racemosa* as easily and economically as he now removes *Cuscuta Trifolii* by the sieve method. The method, like that of some other cleaning machines, is based on the fact that the coat of a dodder seed is somewhat rougher and less polished than that of a clover seed. Advantage is taken of this in a novel manner. The seed is mixed with a magnetic powder, and more of this adheres to the rough coats of the dodder seeds than to the smooth coats of the clover seeds. The seed is then passed under a magnet which draws out the seeds bearing sufficient of the powder to be magnetically attracted. By this means not only can an absolute elimination of dodder be made, but there are also removed broken seeds whose rough surfaces hold the powder and rough-coated weed seeds such as Cut-leaved Cranesbill. The clover seed is then put through a polisher to remove adhering powder.

The first commercial machine working on the principle outlined above has been in use for six months, and has given remarkably good results, a single treatment removing every seed of dodder from a bulk of Chilian red clover. Apart from



its efficiency for removing dodder the importance of the process lies in the very small wastage. The machine has dealt with over 50 tons of seed, and the total cleanings are not much more than half a ton, so that it follows that the amount of good seed removed is negligible.

It is not claimed that the process results in a product free from impurity, but that its importance lies mainly in the fact that it provides a means of removing large seeded dodder from red clover, or in fact any dodder from any clover, with very little waste.

In conclusion, the present position regarding dodder in England can be summarised briefly:—

1. Small seeded dodder (*Cuscuta trifolii*) is probably on the decrease owing to greater attention paid to cleaning. This seed can be easily removed from red clover by screening.
2. Large seeded dodder (forms of *Cuscuta racemosa*) appears to be increasing, and may possibly be gradually acclimatising itself. It cannot be easily removed from red clover by screening, but a new process of magnetic separation seems to offer very great promise of supplying a simple and economic means of overcoming this difficulty.

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## COUNCIL OF AGRICULTURE FOR ENGLAND.

THE Eleventh Meeting of the Council of Agriculture for England was held on Thursday, 13th December, 1923, at the Middlesex Guildhall, Westminster. The chair was taken by Sir Douglas Newton, K.B.E., M.P.

**Appointments to Agricultural Advisory Committee for England and Wales.**—A meeting of the members of the Council representing County and Borough Agricultural Committees was held before the meeting of the full Council, for the purpose of electing two members to serve on the Agricultural Advisory Committee to fill the vacancies caused by the resignations of Lords Aylwin and Bledisloe. It was decided that in the event of more than two candidates being suggested for the vacancies a ballot should be taken, and the first two names in the order of the voting should be declared elected. The names of Lord Aylwin, Lord Bledisloe, and Mr. Harry German, were proposed for the election, the first two on the assumption that they would be willing to be re-elected, having in view the circumstances under which they tendered their resignations. As a result of the ballot Lord Aylwin and Lord Bledisloe were re-appointed.

**Meeting of full Council.**—The Minister of Agriculture said with regard to the item on the Agenda which indicated that he would make a statement, that there was really no statement which he could make. The Government had placed a policy before the country in which Agriculture was largely concerned, and which they hoped would be very much to the benefit of the industry. The country had decided against it, and, therefore, he did not think he could usefully say anything at the moment.

**The Council's Use and Functions.**—Lord Clinton moved:—

“That in order that this Council may be enabled to carry out the duties for which it was appointed, it is essential that opportunities should be given for the discussion of changes in Agricultural Policy before the Government is committed to them.”

In his speech he referred also to the ineffectiveness of the Council as illustrated by the Agenda paper for the Meeting. He said that the Council was a thoroughly representative body, but that it had failed in its work. The causes were, he thought, several; it was largely due to its somewhat too close official connection with the Ministry of Agriculture. The Council also met once in 6 months, and it was absolutely impossible to carry on any work effectively with only two meetings per annum. To be effective the Council required to have an Executive or other Committee. He would like to see a Committee of the Council now appointed to inquire in what way the procedure could be altered so as to make its work effective for the industry which the Members presume to represent. Lord Selborne, in seconding the motion, said that in his opinion those who suggested that the Council should be abolished were making a great mistake. If the Council were compared with other agricultural bodies, it would be seen that it had advantages which none of them possessed. It represented owners,



farmers and labourers, education and research, and minor agricultural industries, as well as being extraordinarily representative in a geographical sense by reason of its County and Borough Agricultural Committee members. He thought it was partly the fault of the members of the Council themselves that the Council had been of such little use, and partly the fault of the Ministry of Agriculture. It was quite true that whatever Ministry was in office, from whatever party it was drawn, the Agricultural Policy adopted by that Ministry would eventually be the policy of the Ministry of Agriculture, for which it would have to be responsible. Instancing the action taken with regard to the importation of breeding stock from the Dominions, he did not question the right of the Ministry or of the Government to adopt that policy if, on the whole, it was thought to be a sound policy, but he did object to the reasons given. The Minister of Agriculture had said that the Council had unanimously given him certain advice, but that he had put that advice aside and had accepted advice given him by the Agricultural Committee of the House of Commons, from what, he understood was the advice of the Royal Agricultural Society and the Stock Breeding Societies. He did not dispute the right of the Minister to set aside the advice of the Council, but he did dispute the right to put another body as a rival authority to the Council.

*The Minister of Agriculture* said that the Council had been set up by Statute to assist the Ministry in the execution of its powers and duties. It was laid down in the Act that the Council should meet at least twice a year for the purpose of discussing matters of public interest relating to agriculture or other rural industries, and such meetings were to be held in public. The Minister was not a member of the Council, he came only by invitation, and had no power to initiate discussion. The whole of the proceedings were in the hands of the Council itself. At the initial meeting of the Council, Lord Lee had indicated the scope and functions of the Council, which the Minister again outlined. He added that Lord Clinton's motion was one which presented some difficulty in view of the fact that the Minister was not a member and had no power to initiate discussion. There was also the difficulty which everyone realised of publicity. When matters of policy in agriculture or any other Department of State were being considered, it was not desirable to have a full dress debate in public in the early stages. There was also the difficulty of time. Important decisions on agricultural and other matters were often taken in a short time, and the people concerned often pressed for a decision. The deputation from the National Farmers Union, which went first of all to Mr. Bonar Law and then to the present Prime Minister recently, certainly on the second occasion, made a great point of wanting a very early reply. The question of time was a factor which made it difficult to call an extraordinary meeting of the Council before any important decision was taken. Another thing which ought to be borne in mind was that it was not always easy to get Governments to initiate a policy, and if it was known that a policy had to be discussed in public before it was initiated, it was at all events worthy of consideration by the Council as to whether it was not likely that less instead of more might be done. He did not want to influence the decision of the Council one way or the other, but he thought it was his duty to put forward these considerations so that the Council would vote with its eyes open, knowing exactly what it was doing.

Mr. Ashby, Mr. F. J. K. Cross, Mr. R. Bruford, Col. Courthorpe, Lord Bledisloe, Mr. Christopher Turnor, Mr. Dallas, Alderman Davis, and Mr. Spraggon also took part in the debate. Mr. Cross suggested an amendment—

“That a Committee of this Council be set up to consider and report in what manner the work of the Council may be made more profitable to the interests of Agriculture,”

which was seconded by Mr. Bruford. As a result of the discussion it was agreed that the proposed amendment should be treated as an addendum to the original resolution, which was then carried in the following terms:—

“That in order that this Council may be enabled to carry out the duties for which it was appointed, it is essential that opportunities should be given for the discussion of changes in Agricultural Policy before the Government is committed to them; and that a Committee of this Council be set up to consider and report in what manner the work of the Council may be made more profitable to the interests of Agriculture.”

It was decided to set up a Committee of eleven, as follows:—Mr. G. Dallas, Lord Clinton, Mr. Dan Crawford, Mrs. Hugh Middleton, Mr. P. Manwaring, Professor T. B. Wood, Sir Gilbert Greenall, Sir Merrik Burrell, Mr. W. J. Fitzherbert-Brockholes, The Hon. E. G. Strutt, and the Chairman, Sir Douglas Newton.

**Summer Time.**—Mr. Jas. Hamilton moved the following resolution:—

“That this Council recommends that in the event of the Daylight Saving Bill being renewed for 1924, it shall operate from the first Sunday in May until the first Sunday of September. If it goes beyond that date, it should continue until the last Sunday in October on account of the potato harvest.”

He said that a strong deputation had recently waited upon the Home Secretary, asking that the Daylight Saving Act might be extended and made permanent. What farmers asked was that townspeople should have the benefit of it with as little injury as possible to those engaged in farming, and therefore that the first Sunday in May should be the date of operation and the first Sunday in September the date of its conclusion. With regard to the first date, it should be remembered that for six months the workers engaged on milk-producing farms were engaged in feeding and milking cows in the dark, and the Daylight Saving Act meant throwing them back another month. In the North of England, farmers would like to see Daylight Saving end on the first Sunday in September because that was the harvest month. At whatever time they finished at night they had to start at the same time in the morning, because it was necessary to get the milk away. It frequently meant a 15-hour day. If this proposal was not agreed to, an extension of Daylight Saving to the last Sunday in October would be a benefit to the potato growers, as it would allow them more daylight in which to harvest their crops. He added that October was the only month in the year in which Daylight Saving could be of benefit to the farmer. The motion was seconded by Mr. G. G. Rea, C.B.E. In his speech he pointed out that Daylight Saving affected the arable farmer in haymaking and harvest time in the North of England. There was the extra hour of dew in the morning, which meant that something else had to be done to fill up that hour, and people were asked also to work abnormally long hours in the evening



to make up for it. The argument that farmers were not bound to abide by any particular hours was true, but there was a practical objection that it added immensely to the labours of the housewife, who is often the hardest worked person in the community. She would have two time-tables, one for the working members of her family and another for the children going to school. He was strongly of the opinion that Daylight Saving should be discontinued except for the four summer months. If, however, that was impossible, then he thought it should continue to the end of October, because at that particular time of year an hour in the evening was of more value to agriculture than an hour in the morning. In the course of the discussion, in which Lord Bledisloe, Mr. Cross, Mr. Nunneley, Col. Courthope and Mr. Spraggon took part, it was proposed by Mr. Nunneley, and seconded by Lord Bledisloe, that the second part of the resolution should be deleted. The amendment was put to the meeting and lost by 31 votes against 18. The original motion was then put to the meeting and carried.

**Foot-and-Mouth Disease.**—Mrs. Hugh Middleton then moved the following resolution:—

“That this Council, while paying grateful tribute to the work of the Ministry of Agriculture in trying to eradicate Foot-and-Mouth Disease in this country, respectfully submits that, in view of the fact that years of strenuous effort on the part of the Ministry has failed to attain its object, it would appear that its policy is based on a wrong principle and should be reconsidered and adjusted on the following lines, viz.: That Foot-and-Mouth Disease continue to be a notifiable disease, but that owners be held responsible for the isolation and cure of their stock on the understanding that the goodwill and expert advice of the Ministry is at their service; and that the policy of slaughtering infected animals be discontinued and therefore no further compensation be paid.”

The mover explained that she had raised the matter as she was anxious to throw some light on the problem of the disease. She was first able to make a close study of it in February, 1922, and had offered to give evidence before the Departmental Committee on Foot-and-Mouth Disease which sat in that year. She had been enormously impressed by the care which that Committee had given to their investigation and by the efforts of the Ministry in the eradication of the disease. But the fact nevertheless was that the machinery set up for this purpose did not work. She considered that if the disease were left to the courage, commonsense and perseverance of the British farmer, and, in a policy of isolation rather than slaughter, if use were made of the spirit of goodwill which existed between the Ministry and the farmers, the former giving all the expert advice it could, progress would undoubtedly be made and the disease wiped out. If this course were adopted, no compensation would be necessary as no animals would be slaughtered. In the course of her speech, Mrs. Middleton pointed out that the Committee's recommendations in regard to the proper disinfection of weighbridges, docks, railway trucks, etc., were not being carried out. She also referred to the brutal methods which had been employed in some cases in the slaughtering of animals infected by, or suspected of, the disease. The motion was seconded by Alderman T. Davis, and a discussion followed in

which the Minister, Mr. Patterson, Alderman Carter, Mr. McCracken, Mr. Egerton Quested, Sir Merrik Burrell, Mr. German, Mr. Nunneley, and Mr. W. R. Smith, M.P., took part. Mr. Patterson pointed out that clearly in the early stages of an outbreak safety lay in immediate slaughter, and that while this was maintained, compensation must be paid. The only point he wished to raise was whether the time had not arrived when the authorities should seriously consider whether they ought to carry on with the policy of slaughter. The test of any policy was its success or failure, and he was afraid that the Ministry would shortly be driven to the conclusion that the slaughter policy was not successful.

The Minister said he could not allow certain statements which had been made by Mrs. Middleton, though made in good faith, to go forth without a word of protest. There was no ground, he was informed, for any accusation of cruelty. At the same time, he would gladly look into the details of any cases which Mrs. Middleton would give him. With regard to the merits of the slaughter policy, the question was one on which the opinion of the Council would be exceedingly valuable. The experience of those who had tried it was that isolation on a large scale broke down. It was quite true that a pedigree herd could usually be isolated because people who kept pedigree herds had the very best equipment and a fairly ample staff of men; but to isolate in every case with an enormous number of outbreaks was quite impossible. Without slaughter, they would have Foot-and-Mouth Disease always with them. The Government was prepared to adhere to the policy of slaughter up to at least £1,500,000. The Ministry were taking all possible steps to expedite slaughter in the bad areas—Shropshire and Cheshire. The improved measures had had considerable effect in the last few days. He agreed with the mover of the resolution that everything possible ought to be done in the way of investigation and research, and the Government was going to ask the highest medical authority to act in consultation with and to advise the Ministry. Mr. McCracken moved an amendment to the resolution:—

“That the Ministry of Agriculture be requested to use all the means at their disposal in the direction of research into Foot-and-Mouth Disease, and that meanwhile the Council leave the matter in their hands.”

Mr. Nunneley seconded the amendment, giving particulars of the very grave losses which he had sustained in his early farming years. He added that anybody who knew the condition of the herds of the country in the years from 1868 to 1882 would not advise any Minister to do away with the policy of slaughter. The amendment was by leave of the Council withdrawn.

Sir Merrik Burrell then moved a further amendment:—

“to omit all words after ‘respectfully’ in the original motion, and substitute the following: ‘urges it to continue the policy of slaughter until such time as the Veterinary Authorities recommend otherwise.’”

He stated that this was the sense of the absolutely unanimous opinion expressed at the general meeting of the Royal Agricultural Society on the previous day. Mr. German seconded this amendment, stating that he had been at a meeting at Crewe last week to discuss the question with those who were suffering more than anybody else in England on account of the disease, and after a very long discussion, a resolution



was carried leaving the matter entirely with the Ministry to proceed in such manner as it thought best. He suggested that the Minister be asked to place at the disposal of the Press an absolutely impartial memorandum on the whole question, which by the courtesy of the Minister he had read. Sir Merrik Burrell's amendment was then put and carried. It read as follows:—

“That this Council, while paying grateful tribute to the work of the Ministry of Agriculture in trying to eradicate Foot-and-Mouth Disease in this country, respectfully urges it to continue the policy of slaughter until such time as the Veterinary Authorities recommend otherwise.”

**Reports.**—The Report containing further information as to the Ex-Service men settled on the land in England and Wales which had been laid before the Council was received; also the Half-Yearly Report (No. 6) to the Council of the Proceedings of the Agricultural Advisory Committee for England and Wales, a copy of which is printed below. Mr. Fitzherbert Brockholes suggested on paragraph 10 of the Half-Yearly Report that it would be advisable that four of the eight persons interested in the Milk Industry which were to be appointed by the Minister to the Milk Advisory Committee should be actual producers. At this point, Mr. Robbins raised the question of a successor, and there being found to be not one-third of the members present, the proceedings terminated.

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## AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

THE following is the half-yearly report (No. 6) to the Councils of Agriculture for England and Wales, on the proceedings of the Agricultural Advisory Committee:—

The Agricultural Advisory Committee has met six times between the date of the last report, which was issued on the 3rd May, 1923, and that of the present report—viz.: on 6th June, 11th July, 1st August, 10th August, 3rd October and 7th November, and has discussed the following subjects, with the results stated:—

(1) **Stimulation of Urban Interest in Agriculture.**—At the last meeting of the Council, a resolution was passed:—

“That it is necessary to stimulate on the part of urban and industrial communities greater interest in the development of agricultural England.”

This resolution was referred by the Council to the Agricultural Advisory Committee to consider what steps could be taken to give effect to it. The Committee discussed the matter and decided that, in addition to the work which was at present being done by various unofficial organisations, special steps might be taken through the British Empire Exhibition of next year, and the Committee made a recommendation to the Ministry accordingly. Two members of the Committee were eventually nominated to sit on a Committee “to advise the Ministry and to co-operate in the preparation of the agricultural exhibit at the British Empire Exhibition.”

(2) **Importation of Foreign Potatoes.**—A resolution was passed at the last meeting of the Council :—

“ That the Government be urged to take steps to avoid disaster to the potato industry of the country.”

The Committee was informed that the Government had already announced that it was not prepared to place an import duty on foreign potatoes at the present time, but that the position would be reconsidered if need should arise after this season's crop had been gathered. In these circumstances, the Committee did not think that it could usefully take further action.

(3) **Charges for Licences to sell Certified Milk, &c., under Ministry of Health Order.**—It was reported to the Committee that the Ministry had taken up this matter with the Ministry of Health, but that there appeared to be no prospect of reducing the charges at the moment. It had been laid down by the Treasury that the services of inspection, &c., under the Milk (Special Designations) Order should be paid for by those concerned. Furthermore, the fee for “certified milk” licences was £5, and that that fee was the highest in the scale of charges. So far, no more than 50 licences for the sale of this class of milk had been issued, and the holders of these who sold the milk at 6d. a pint would very soon recoup themselves for the cost of the licence. It was pointed out that the new Order setting out the charges would have to be laid before Parliament for a period during which objections to it might be taken, and that in the circumstances, the matter was one which might very properly be raised in debate in either House.

(4) **The Grant of £850,000 for Agricultural Education and Research.**—The question of supplying Sparsholt Farm Institute with a new Hostel at an expenditure of £14,000, of which three-quarters would come from the Fund, was considered. It was suggested by the Committee that a limit of £10,000 should be fixed, subject to the Ministry making any small increase later, if such a course were found to be necessary.

The point was raised in Committee as to whether, in view of the fact that the Fund was not guaranteed after March, 1927, certain scientists who were working under it might, unless they were assured of continuance of service after that date, relinquish their work in favour of more permanent posts elsewhere. It was stated on behalf of the Ministry that although in the nature of the case no absolutely definite undertaking could be given, there was not any reasonable room for doubt that the Government in 1927 would uphold the undertaking which had been given by the Treasury that schemes started out of the fund recently placed at the disposal of agricultural education and research would continue to be maintained after 1927.

(5) **The Proposed Tax on Imported Malting Barley.**—The Committee considered correspondence between Government Departments which showed that unforeseen difficulties had arisen in the way of levying an Excise duty on malting barley, and decided to leave the matter in the hands of the Ministry to make the best arrangement possible in the circumstances. Later, alternative schemes were discussed and recommendations made. At a meeting on the 3rd October, however, the Minister informed the Committee that a Departmental Committee was being set up to consider the various methods which had been suggested of levying a Customs duty, not an Excise duty, upon imported malting barley and to report what in their opinion is the



most convenient form of duty. The Advisory Committee asked that the Departmental Committee might be requested to report as soon as possible.

(6) **Imperial Economic Conference.**—At the meeting on the 11th July, the Committee considered various memoranda circulated in connection with the items of the preliminary agenda for the Imperial Economic Conference. It was agreed at this meeting that a separate small Advisory Committee should be appointed for the purpose of advising on all agricultural questions which would or should be brought up at the Conference. Five members from the Agricultural Advisory Committee were nominated for this purpose (*viz.*, Lord Bledisloe, Mr. McLaren, Mr. Robbins, Mr. W. R. Smith and Mr. C. D. Thompson), with power to co-opt two representatives of the Agricultural Committee of the House of Commons (Mr. Pretyma and Mr. Percy Hurd were subsequently appointed), and, later, Sir Merrik Burrell, of the Livestock Defence Committee.

This Sub-Committee considered memoranda and advised on several matters, including Imperial Agricultural Policy and Imperial Preference, Overseas Settlement, Importation of breeding and store stock from Canada and the Dominions. It also had unofficial meetings with representatives of Dominion Agriculture who came to this country in connection with the Economic Conference.

(7) **Report of Agricultural Machinery Committee.**—A Memorandum was circulated stating and discussing the principal recommendations of this Committee, from which it appeared (1) that the Ministry could not undertake to carry out machinery research direct, (2) that before any progress could be made a centre for the new Agricultural Machinery Research Institute, which the report proposed, had to be decided upon, (3) that the Ministry had selected Oxford as the best centre for the Institute. The Committee discussed this choice and some of them were in favour of Cambridge as the centre. It was stated, however, that the Ministry was now fairly definitely committed to their offer to Oxford and could hardly withdraw it. It was finally agreed that the Committee should ask the Ministry to reconsider the whole matter if it proved, on further enquiry, that the present negotiations with Oxford had not gone too far for this to be done.

(8) **Importation of Breeding Stock.**—Lord Ailwyn at the meeting on 1st August brought before the Committee the following resolutions which had been passed by the Council of the Royal Agricultural Society :—

“That this Council is strongly opposed to the suggested importation of breeding stock from other parts of the British Empire.”

“That the Council of the Royal Agricultural Society of England strongly protests against any renewal of the practice of giving pledges at the Imperial Conference to the detriment of British Agriculture, without either the knowledge or consent of Parliament or British agriculturists.”

Mr. McLaren also brought before the Committee the following resolution which had been passed by the Shorthorn Society :—

“The Council of the Shorthorn Society deplores the action of the Government in proceeding to the preparation of an Order for the admission of breeding cattle from Canada before having fully ascertained the opinion of all those primarily interested in the breeding of cattle in

this country, and before experience has shown the effect of the admission of store cattle. The Council is of opinion that the admission of bulls is indefensible, and that there is at present no shortage of breeding females such as alone could justify the precipitation of the Government in preparing this fresh Order, especially at a time of crisis in agricultural affairs for which no effective remedy has yet been suggested. The Council is of opinion that should the Government unfortunately determine to put the Order in force no advantage would be gained by stipulating for an abortion test, and that if there is to be a test for the detection of tuberculosis its precise nature should be clearly defined."

The subject of these resolutions was discussed. It was pointed out that the Importation of Animals Act passed last year had made provision for the admission of breeding stock, and that, therefore, the question to be settled was rather on what terms they ought to be admitted than whether they should be admitted at all. The Committee, however, after further discussion passed the following resolution:—

"That this Committee is strongly opposed to the suggested importation of breeding animals from other parts of the Empire."

It was understood that this Resolution was a re-statement of the Committee's views upon the matter, but would not, if the Government decided that there was no other course but to make the Order proposed, debar the Committee from expressing an opinion on the terms of the Order. It was also decided that a special meeting of the Committee should be convened at an early date, to discuss the whole situation in regard to the importation of breeding and other cattle.

At the special meeting, the Minister referred to the resignation from the Committee of Lord Bledisloe, which had taken place over the question of the admission of breeding stock because of the confliction which His Lordship felt between his duty as a member of the Council of the Royal Agricultural Society and that as a member of this Committee. As a result of a careful consideration of all the circumstances, the Advisory Committee came generally to the conclusion that they saw no reason to depart from the views which they had expressed at the last meeting. At the special meeting the Committee had the benefit of the assistance of Sir Merrik Burrell, who had been invited to attend. The Minister intimated that he saw no alternative but that the Government should proceed on the lines of allowing reciprocal importation of pedigree stock between the Dominions and the United Kingdom.

The resignation of Lord Ailwyn was laid before the Minister at the next meeting of the Committee, when the Minister expressed the regret which the Committee felt at the resignations of both Lord Ailwyn and Lord Bledisloe over the question of the importation of breeding stock.

At the meeting on 7th November, the Minister reported to the Committee that it had been agreed at the Imperial Economic Conference that the matter should be proceeded with on the lines of reciprocal arrangements for the admission of pedigree stock, and that, with regard to store stock from Canada, the difference between the accepted meaning of fat and store stock should be defined as accurately as possible.

(9) **Foot-and-Mouth Disease.**—At the meetings of the Committee on the 3rd October and 7th November reports were made as to the position and prospects in relation to the disease; which were considered and discussed by the Committee.



(10) **Milk Advisory Committee.**—The recommendation in Lord Linlithgow's Committee's Report on Milk and Milk Products for the appointment of a Standing Milk Advisory Committee was considered, and it was agreed that the Committee should consist of official representatives, with eight persons interested in the milk industry to be selected by the Minister.

(11) **Agricultural Conference at the British Empire Exhibition.**—The Committee agreed that the Ministry should obtain the views of the National Farmers' Union and the Royal Agricultural Society on a proposal to hold an agricultural conference at which administrative and technical agricultural questions should be discussed.

(12) **Proposed Subsidy to Arable Agriculture.**—The Committee at their meeting of 7th November discussed the letter from the National Farmers' Union on the position of arable agriculture, which the Minister had transmitted to the Prime Minister and which would shortly be considered by the Cabinet. Certain views were voiced by members, but it was agreed that the Committee would not at this stage express an opinion on the suggestions in the letter but would if required by a Cabinet Committee submit them, covering points of detail, at a later date.

(13) **Power of County Councils to make Restrictive Regulations on the Movement of Animals.**—The position in this matter was considered and the question raised as to whether the old Order of the Ministry which gave the Local Authorities this power should not now be modified so as to require them to get the Ministry's approval to draft orders before issue. The Committee agreed that that appeared now desirable but the matter was adjourned for certain further information.

(14) **Report of the Proceedings of the Various Advisory and Departmental Committees set up by the Ministry.**—One report was received by the Committee under this head in the period under review. It was dated 24th July, 1923, and dealt with the proceedings of the Agricultural Prices Committee, the Tribunal of Investigation into Agricultural Conditions, the Agricultural Meteorological Conference, the Basic Slag Committee, the Electro-Culture Committee, the Agricultural Research Council, the Conference of Advisory Officers, the Advisory Committee on Agricultural Science, the Methwold Management Committee, the Allotments Advisory Committee, the Warble Fly Committee, the Central Scholarships Committee, the Horticultural Advisory Committee, the Poultry Advisory Committee, and the National Poultry Institute Advisory Committee.

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## TURKEY REARING ON LIMITED AREAS.

E. T. BROWN.

An impression which is firmly fixed in the mind of the modern poultry-keeper is that it is essential to have unlimited space for turkey raising. This belief, like many another founded upon the paucity of one's knowledge, has now been exploded, and it has

been proved that turkeys can be raised equally successfully on a limited area of land as when given a free range.

The one thing lacking in the past was to discover a system which would bring about the desired results. That such a system could be found was indicated by the enormous advance that has been made in the production of eggs from ordinary fowls. Twenty years ago winter eggs were few and far between; to-day tens of thousands of pullets and hens lay throughout the cold weather. This has been rendered possible, not altogether by breeding, but principally by the alterations that have taken place in management. Early hatching, the provision of a scratching-shed for use in bad weather, a method of feeding that encourages the birds to take exercise, the judicious use of animal foods, such as meat meal and fish meal, and artificial illumination of the house during the dark evenings, have conjointly made the winter-egg yield almost equal to that of spring and summer. The great influence of management is an undisputed one.

The only reason why a system of rearing turkeys on small areas has not been generally practised hitherto is that the average poultry-keeper is conservative to a degree, and firmly believes that wide liberty for the birds is essential to success. Being convinced on this point he has never troubled to give the matter a second thought.

**A System That Works.**—One of the most successful turkey raisers I know only possesses a total of  $3\frac{1}{2}$  acres of land, of which close upon 3 acres is woodland. The soil is medium to light, naturally well-drained, and the district is a kindly one as regards climatic conditions. These are, of course, contributory factors, and without them results would not be nearly so good.

The best breed for the purpose is the Cambridge bronze. A very important point is to rely upon fully matured birds for the breeding pen. The hens should not be less than 3 years old: the stags 2 or 3 years of age. The male, too, must be unrelated to the hens. In-breeding weakens the stamina and undermines the constitution.

The breeding flock is boarded out from June to February on a neighbouring farm. This is not an essential part of the system, but when it can be done it is an advantage. The pen is brought in at the beginning of February, so that the birds can grow accustomed to their surroundings before the laying season approaches. The breeding birds are housed in a large



open-fronted shed, each bird being allowed 12 sq. ft. of floor space. This house is placed at one end of a wire-netted run 100 ft. long by 18 ft. wide. The run is planted with fruit trees, which help considerably to keep the ground pure and sweet.

Turkey hens do not like to share a nest with other birds. The necessary number of crates, with a sufficiently large hole cut in one end, should be dotted about the run. Each hen will select a nest for herself and stick to it throughout the laying period. The nests should be visited every day and the eggs removed.

**Feeding the Breeders.**—As a grain ration the breeding birds are fed upon oats (2 parts) and wheat (1 part), this being given half in the morning and half in the late afternoon. For the remainder of the day they are supplied with dry mash in a self-feeding hopper. Any good dry mash that is employed for ordinary laying hens answers admirably. If soured milk or soured skim milk be available, the meat meal or fish meal should be omitted from the dry mash. If either of these can be obtained, it should be given at midday at the same time as a liberal supply of succulent green stuff is fed. On no account should the green food be omitted.

A supply of grit, oyster shell and granulated vegetable charcoal should always be before the birds. To keep the digestive troubles which are always lurking round the corner of every turkey house in their proper place, these three items should not be allowed to run short.

**Hatching the Eggs.**—As the eggs are laid they should be placed under reliable hens for incubation. A large hen will cover a dozen turkey eggs easily, but it is better to limit the number to eight or ten. Removing the eggs encourages the turkey hens to lay a larger number; if one should show signs of broodiness she can be broken in the usual way even more easily than can a general-purpose breed fowl. During the last four or five days of incubation the eggs should be damped with warm water just before returning the sitting hen to her nest.

It is advisable to set a number of hens at the same time. When the hatches are all completed the best hens should be chosen and each one given 20 to 25 turkey chicks to mother. These hens can be placed in double coops, but a better plan is to employ a brooder house divided into compartments 2 ft. wide, with long open runs of a similar width in front. Each section accommodates a hen and her brood for the time being.

By the time the youngsters are a month old they are too large

to nestle under the hen, but they still require looking after. The partitions in the brooder house are, therefore, taken away and three or four batches of turkey chicks are given to one hen—the best for mothering purposes—and allowed the run of the whole brooder house. The partitions, too, in the runs are removed, thus giving one run  $\frac{1}{4}$  acre in size.

The youngsters remain in the brooder house until they have “shot the red.” As soon as this period has been passed successfully the young turkeys are taken to the woodland run. This is about 3 acres in extent and fenced with 6 ft. netting. The birds are housed in open-fronted sheds, but whenever the weather is at all fine the birds prefer to sleep in the branches of the trees. The provision of sheds is, however, essential in case of bad weather.

**Importance of Correct Feeding.**—The system of feeding adopted during the early days is of great importance. The following is the plan adopted by the breeder referred to above:—The hen requires a good feed of wheat and oats both morning and afternoon for the first three weeks; this is taken for granted. When the brood is two days old a little wet mash, consisting principally of soaked biscuit meal and Sussex ground oats is supplied upon a board in the morning, again about noon and for a third time about 4 p.m. In addition pinhead oatmeal is supplied at 10 a.m. and 2 p.m. Skim milk is used for mixing the wet mash, and once a day a teaspoonful of Epsom salts is dissolved in this for each twenty-five birds.

On the third day, the feeding is practically the same, but when the wet mash is fed sufficient chopped dandelions, nettles or onions are mixed with it to double its bulk. From this time onwards soured skim milk, as well as fresh water, is kept constantly before the youngsters.

At ten days old the feeding times are reduced to three a day. The first feed is wet mash, pinhead oatmeal at noon, and wet mash again in the late afternoon. The green food is still added to the mash at each meal. At this time the daily dose of Epsom salts is reduced to twice a week. When the chickens are three weeks old the pinhead oatmeal is mixed with an equal quantity of a good dry chick feed. The grain feed is now given in the morning and as a last feed, and at noon fresh, crisp, succulent green stuff is supplied. Wet mash is only given once a week at midday: this so that a weekly dose of salts, which must be increased as the birds grow, can be given in a suitable medium. This is continued until the birds are removed to the woodland



run, the quantity supplied being increased as the needs of the birds call for a larger amount.

On removal to the woodland run the birds are given a feed of three parts oats and one part wheat in the morning and again in the afternoon; at midday they are supplied with as much green food as they will eat, together with all the soured skim milk they require. The weekly dose of Epsom salts is continued, this being given in soaked pinhead oatmeal as the afternoon meal.

Six weeks before the birds are due to be killed they are brought up from the woodland run and placed in the breeding pen. The food is the same, except that a little whole maize is added. Three weeks before killing the soured skim milk is used for mixing up the fattening wet mash which consists of equal parts of Sussex ground oats, middlings and bran, and not given separately as heretofore. The wet mash is fed at morning and noon and grain in the afternoon.

**The Two Important Foods.**—As will be seen by the foregoing the two most important items in the diet are soured skim milk and green food. It is impossible to lay too much stress upon the need for both of these daily right from the time the chicks are three days old until three weeks before they are killed.

During the year 1921 89 turkey chicks were hatched and 84 marketed; in 1922, 103 were brought out, of which 99 were successfully reared and marketed; this year, 117 were hatched and at the present time there are 114 strong, lively birds running in the woodland enclosure. And these numbers have been raised upon a total of  $3\frac{1}{2}$  acres of land, the greater part of which is useless for any agricultural purpose.

Raising turkeys on small areas has been proved successful; and one may confidently expect that many others who have the necessary small area of land will take up this branch of the poultry industry.

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## THE IMPERIAL FRUIT SHOW, 1923.

## II.

J. TURNBULL and A. WHITING,  
*Ministry of Agriculture and Fisheries.*

**Apples.**—*United Kingdom Section (cont.).—Bramley Seedling.*—The first prize in the half-barrel class went to Kent for a fine exhibit of coloured fruit which gained full marks for pack. One barrel was not quite up to the others, and the size was not quite uniform. The second prize lot from Wisbech were well packed, green Bramleys, typical of this variety at its best. The price realised. 33s., exceeded that of all other exhibits of cooking apples in the Show, except Kentish Blenheim Orange, which it equalled. The third lot came from Malvern and were also fine specimens, well packed but rather irregular in size. These three exhibits stood out above all other Bramleys in the Show. Some from Norwich approached them in quality of fruit, but the pack was slack and very low—probably due to woodwool at the bottom of the barrel.

In the bushel class the first prize was awarded to very highly coloured Bramleys hardly typical of the variety and packed much too high above the rim. Towards the close of the Show it was noted that this exhibit was rapidly going off condition. The second prize went to West Midland Bramleys in very good condition, but very uneven in size and low in the pack. The third lot were from East Suffolk, Bramleys of typical colour and shape, in fine condition, but pack rather uneven. Mention should also be made of the Kentish exhibit which was first in its own section and realised the same price as the winner of this class. They were very well packed, in very good condition, but rather small.

*Newton Wonder.*—The winner of this half-barrel class came from Kent. The fruit was on the small side, but of fine colour and the pack was almost perfect. This particular exhibitor showed very good packs in every package, but in half barrels no other exhibitor approached the perfection of his pack. To this was due not only the very large number of prizes won, but also the very high prices realised at the auction sale by his exhibits. The second prize in this class went to Malvern for fine highly coloured fruit, a little uneven in size and pack. This exhibitor's Newtons were almost perfect specimens in every respect except for the prevalence of bitter pit. The third prize



exhibit from Wisbech consisted of very fine, large Newtons. The pack was very uniform in colour and size, but a bit low and slack.

In the bushel class the first prize went to Evesham for a very well packed exhibit of highly-coloured Newtons. They were rather off condition and showed bitter pit. The second from Kent were also well packed though lacking in crown, highly-coloured and rather on the small side. These made a considerably higher price.

*Lane's Prince Albert.*—The first prize in the half-barrel class went to Kent for very highly-coloured Lanes, which, however, were not typical of the variety. They were beautifully packed, but not uniform in size. The second from Herefordshire were also very highly coloured, but not typical of the variety in colour or shape, and too forward in condition. The second prize West Midland Lanes adjoining this exhibit appeared to be in better condition and of more typical colour and finish. The pack was full but slack and not uniform in size. The Norfolk Lanes which were placed third, were typical Lanes in good condition, but the grading was very uneven both in size and colour. If the prices realised at auction are compared with the awards, it is apparent that in all these classes for cooking apples, the judges attached considerably more importance to exceptional colour than the buyers did. Exceptional colour is usually—though not always—gained under circumstances which also cause poor condition of the fruit, and this is a point which should be borne in mind in future.

*Any other Variety.*—In half barrels the first prize went to very fine, large, well coloured Blenheim Orange in good condition, from Evesham. These were typical of the best of this variety as sent by this exhibitor. The second prize from Kent was exceptionally well packed and realised a much higher price. The third prize also went to Kent.

In bushels the first prize went to well packed typical green Lord Derby from Wisbech, but like other exhibits of this variety it was too forward in condition and showed a little bitter pit. Second and third prizes went to Kent.

*Small Holders Classes.*—There were but few entries in these classes, the numbers in the three classes being as follows :—

			<i>Kent.</i>	<i>East.</i>	<i>West.</i>
Class 15.	Half sieves dessert apples	...	1	...	3 ... 2
" 16.	" barrels cooking "	...	—	...	1 ... —
" 17.	Bushels " "	...	1	...	3 ... 1

Class 15 was won with Cox's Orange by the same Berkshire grower than won in classes 1 and 6. He was also second in class 17. Second in class 15 went to Wisbech and the third prize was divided between two growers in Essex. Class 16 went to a Cambridgeshire grower of some fine Lanes and he gained a second in class 17 with the same variety. In class 17 the first prize was not awarded and the third went to Droitwich.

*Other Sections.*—In the Overseas Section the Associated Growers of British Columbia won ten classes and tied for first place in another out of 16 classes. This is a most remarkable achievement.

**Pears and Other Fruit.**—In the United Kingdom Section pear classes, all three prizes went to Kentish growers, the winner showing a superb exhibit. In *Conférence* pears the third prize only was awarded to a Warwickshire grower, and in any other dessert variety, second and third prizes went to Evesham and East Suffolk. In any variety of cooking pear the second and third prizes went to Kent and East Suffolk. In tomatoes the second prize only went to a Waltham Cross exhibit. In grapes the third prize only was awarded and that went to Worthing.

In the Channel Islands section, one entry gained first prize for dessert pears and there were no entries of grapes. Two prizes only were awarded in the tomato classes for indoor and outdoor grown fruit.

In the Ulster Section the packing showed remarkable improvement on last year. First and second prizes went to the same two growers in each class.

**Auction Prices.**—Interesting lessons may be learned from a comparison of the prices realised at auction with the score card points, with the awards and with the different packages used. It should be borne in mind that prices realised are no more infallible than the judges' decision. The prices do not compare in any way with the score card marks as was the case last year. In several cases of great discrepancy between prices and score card marks, we have a good recollection of the quality of the exhibits and we have no hesitation whatever in supporting the judges' opinion. The view has been widely held that the prices are a kind of acid test of the value of the judges' decisions. After making these comparisons, however, we are confident that the judge is more often right than the buyer—as should be the case.

If the prices are compared with the prizes in the Kent, East, and West Sections, the results are satisfactory. If, however,



the prices are compared with the awards in the United Kingdom Section, curious discrepancies are to be found. A difference of 2s. would hardly arouse comment, but there are several cases where exhibits have been placed ahead of others which realised from 5s. 6d. to 10s. and in one case 13s. more. Had the judges been different, an obvious explanation would arise: but they were not. The same judges judged the same variety in the three sections and in the United Kingdom section as well. In the three sections their verdict is borne out by the prices, but in the United Kingdom section it is not. Many of these differences are undoubtedly due to bad judgment on the part of the buyer, but there are a few in which we would support the buyer's view. In the majority of these cases the exhibits had one or both of two characteristics—they were either of exceptionally high colour or in poor condition or both. Conversely the exhibits which the buyers valued higher than the judges, were in first rate condition, but not specially noted for colour. It is certain that if there are any defects in the score card, they would be revealed in the United Kingdom section, where competition is necessarily keener than in the three home sections. It would appear that the score card should be altered by reducing the number of points given for colour and increasing those given for condition.

Another point worthy of consideration, is whether it would not be better for judging if all apples of one variety were staged together, with sub-headings for the three home sections.

In order to obtain a fair comparison of packages, it seems better to omit prize winners—the price of which is weighted by the prize tickets—and compare unplaced exhibits only. Cox's Orange are a law unto themselves, but a fair comparison cannot be obtained as there were so few entries that nearly all had prize tickets of some kind attached.

Half sieves of "any other variety" made 4s. to 6s. which, after deducting 1s. 6d. for package, leaves 2s. 6d. to 4s. 6d., equal to 5s. to 9s. a bushel. Boxes made 9s. to 14s. equal to 8s. 3d. to 13s. 3d. per bushel. This favours the box, but all these prices were below recent market prices and can hardly be considered a fair test.

A comparison of cooking apples is better owing to the larger classes.

		Average price for unplaced exhibits.			Per bushel after allowing for package.		
		Barrel.	Bushel.	Box.	Barrel.	Bushel.	Box.
Bramleys ...	Kent	15/6	10/9	13/6	9/4	8/3	12/9
" ...	East	17/10	15/10	15/-	10/11	13/4	14/3
" ...	West	17/6	10/3	13/6	10/8	7/9	12/9
Newtons ...	Kent	17/-	11/6	—	10/4	9/-	—
" ...	East	18/-	12/6	18/-	11/-	10/-	17/3
" ...	West	17/-	12/-	12/-	10/4	9/6	11/3
Lanes ...	Kent	16/3	—	13/-	9/10	—	12/3
" ...	East	17/3	—	12/-	10/6	—	11/3
" ...	West	17/-	—	—	10/4	—	—

The averages of these per bushel net are :—

In boxes ...	...	...	13/1 per bush.
„ barrels ...	...	...	10/4 „
„ bushels ...	...	...	9/8 „

showing a small advantage for barrels over bushels and a considerable advantage for boxes over both.

The average prices of exhibits in classes 1-14 in the three sections are also of interest :—

Section.	1st.	2nd.	3rd.	Unplaced.
East ...	23/6	18/2	14/4	13/8
Kent ...	23/8	16/-	13/3	12/6
West ...	21/8	15/6	13/6	11/2

**Sale Catalogue.**—In view of the poor prices realised for fruit of such high and uniform quality, it would appear that some re-arrangement of the sale catalogue might bring about an improvement. It would certainly facilitate matters if the sale of one variety was completed before passing on to another—*e.g.*, Lots 1-50 Cox's Orange Pippin, Lots 51-71 Worcester Pearmain and so on. This, together with all apples of one variety staged together, as mentioned above, would enable buyers to see at a glance exhibits suitable for their requirements. All varieties in "any other variety" classes should, in future, be named in the auction catalogues. This is borne out by the low prices realised for Cox's in Class 1 of the British Empire Section. This variety together with Allington Pippin other than prize lots, averaged no more than 10s. 8d. per box. Similar examples are to be found in the sale of the culinary class in the same section.

The British Empire section should be sold first and not last as under the present system, which necessitates a buyer waiting to the end of the sale to purchase the best apples in the show.

**Packages.**—The general improvement in box packing and the increasing popularity of the non-returnable package, have



done much to favour the elimination of bushels and half sieves at future shows. In the first place, the cost of the new wicker is more or less a dead loss to the exhibitor and secondly, elaborate methods of covering and lining the baskets to prevent bruising, are adopted by many growers—a practice which does not comply with the rule that “All exhibits shall be packed under commercial conditions.” Also, there is unfortunately a considerable amount of pilfering due to easier access to the fruit.

The proved suitability of the box for high grade culinary varieties, as shown in Class 2 of the British Empire Section, even goes so far as to suggest the confining of the Show to the box package only, until such time as a suitable non-returnable barrel can be made at an economic price.

It may be argued that the smaller grower has not sufficient fruit to select from to enter in the seven-box or barrel classes, but the difficulty can easily be overcome by substituting a four-box class in the case of half sieves and a four-barrel class in place of seven bushels, growers of more than 20 acres being excluded.

**“Any Other Variety” Classes.**—Surely it is an anachronism to have any other variety classes at a commercial fruit show. Some exhibitors contend that these classes are especially of interest from the point of view of introducing new varieties. The entries at each of the three Imperial Fruit Shows, however, have brought nothing of merit and usually consist of old well-known sorts, which are now little planted. Why include varieties none of which is of sufficient commercial value to have a named class for it? It is suggested that in place of the “any other variety” dessert classes, a class for 3 boxes of any dessert variety—season to follow Worcester Pearmain and precede Cox’s Orange Pippin—be made. In this way a suitable variety to fill present requirements might be forthcoming in course of time. The class for King of the Pippins might be reinstated, or it might be included with one of the other varieties.

“Any other variety” culinary classes seem to serve no useful purpose and might be withdrawn from the schedule entirely. A new interesting class might be instituted, however, to comprise one ton (56 boxes) of Bramley, Newton or Lane’s Prince Albert, open to the British Isles. Growers of Blenheim Orange, Annie Elizabeth, Lord Derby, Bismarck or King Edward VII might wish to be included, and this point might be considered.

**Rules and Disqualifications.**—There are so few exhibitors now who fail to comply with all the rules, that in future all

rules should be rigidly enforced. Admittedly it is hard luck for the sender of a good exhibit to be disqualified, possibly through a pure oversight, but after all he has only himself to blame, and it is a good deal harder for the other exhibitors who have taken great pains to comply with all rules, to be beaten by a very small margin by such a sender. In order to simplify the awarding of special prizes with peculiar limitations (*e.g.*, growers in certain counties, or members of certain associations, or showing both culinary and dessert), there should be a rule to the effect that "No special prize which is not open to all competitors in a section shall be awarded to any exhibitor who fails to state on his entry form the special prizes for which he is eligible and the reason of his eligibility."

Rule 12 was intended to apply to apples in boxes only. "For apples diagonal on-side packs only may be used." At least one exhibitor thought this applied to all packages, in spite of the fact that it is impossible to use a diagonal pack in a round package. This sentence ought therefore to be re-written. "Diagonal on-side packs only may be used for apples in boxes" would do. This pack is favoured because it is standard for box packing.

It is now recognised that "ringing-in" in round packages is a commercial proposition and if any round packages continue in the show, it might be made compulsory. In connection with this point, it is to be noted that many exhibitors put a thick layer of wood wool in the bottom of the package so as to get the right height. This was the chief cause of slack packs. The only way to build a firm pack to the right height, when this does not happen with all the apples turned the same way, is to pack some layers flat and some on-side. The last layer should preferably be on-side as it gives a better appearance. The correct way to retain the "crown" when "ringing" is to pack the centre apples tightly from the bottom up. Choosing larger sizes for the top centre apples is useless if the crown is not built all the way up. Wood wool in boxes, barrels or wickers is a delusion and a snare. Sparingly used it can be made to serve a useful purpose, but over anxiety makes the exhibitor use too much. Inside the package, anything more than a few strands causes a slack pack and on the top of the package the dusty material contained in it is a nuisance to the user's exhibit and all surrounding it. The use of wood wool in these packages and of hay or fodder should be prohibited entirely. The cleanest and best material to use is stiff wheat straw, laid straight across the package and



with the ends clipped off after tying down. Hay becomes musty with the sweat of the fruit. A card should be sent to each exhibitor stating the packing rules shortly and exactly and for what bad points he will be disqualified. This would avoid much misunderstanding and disappointment.

As a guide to exhibitors on the controversial question of size, we would suggest that a judge's rule should be made to the effect that the following sizes will receive full points for size:—

Cox's Orange Pippin	...	...	150-200 per box.
Any other dessert	...	...	150-175 „
Any culinary variety	...	...	80-96 „

As a further guide a packing card showing the counts to the various packs might be included in the schedule.

In conclusion, we would emphasise the importance of several points:—

- (1) Reduction in the number of classes, especially in the case of "Any other Varieties."
- (2) The adoption of the box for culinary variety classes.
- (3) Tightening up of the Rules.
- (4) Standardisation in judging.
- (5) Increased opportunities for the public to purchase exhibition fruit.

\* \* \* \* \*

## NOTES ON MANURES FOR JANUARY.

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**Phosphates and Potash for Grass Land.**—The value of phosphates, either alone or with potash, for improving the yield and quality of grass land is well known. The increase in clovers following such treatment is usually marked; and under favourable conditions, as, for example, in a soil containing chalk and well supplied with available potash, the response is very considerable. On such a soil at Horndon, Essex, the following results were obtained by Robertson:—

<i>Treatment.</i>		<i>Hay.</i>		<i>Clover.</i>		<i>Grasses.</i>		<i>Weeds.</i>
		cwt. per acre.		per cent.		per cent.		per cent.
Unmanured ...	...	6.4	...	8.7	...	81.4	...	9.9
High soluble slag	...	23.2	...	45.4	...	53.3	...	1.3
Gafsa phosphate	...	22.3	...	63.8	...	32.0	...	4.2

On the continuous hay plots at Rothamsted the average yields for a recent 10-year period, and the botanical analysis for a typical year were:—

<i>Treatment.</i>	<i>Hay (1st crop).</i> cwt. per acre.	<i>Clover.</i> per cent.	<i>Grasses.</i> per cent.	<i>Weeds.</i> per cent.
Unmanured ... ..	10	5.8	54.3	35.6
Superphosphate only ...	13	7.5	55.9	33.6
Superphosphate + sulphates of soda and magnesia ...	17	10.6	62.7	25.8
Superphosphate + sulphates of soda and magnesia + sulphate of potash ...	26	16.9	68.0	14.6

In this case it is seen that to maintain the yield and quality of permanent meadow land, potash is necessary as well as phosphate, and that salts of soda and magnesia, while not so effective as potash for this purpose, have still a definite value.

When land treated with phosphates and potash is grazed, similar results are observed in the herbage. The larger growth and improved quality enable more stock to be carried, and the production of the pasture for milk and meat is increased. The results of a few experiments may be quoted:—

<i>Centre.</i>	<i>PRODUCTION OF MILK.</i>		<i>Increase per Acre per Season over no Manure Land.</i>	
	<i>Treatment per Acre.</i>	<i>No. of Seasons of Experiment.</i>	<i>Actual gal.</i>	<i>Per cent.</i>
Klonakilty Agricultural School	10 cwt. slag	3	63	21
Klonakilty Agricultural School	7½ cwt. slag	2	102	66
Midland Agricultural College	4 cwt. super- phosphate 1½ cwt. sulphate of potash	4	93	58
Harper Adams Agricultural College	2½ cwt. super- phosphate an- nually 2½ cwt. super- phosphate 1½ cwt. sulphate of potash annu- ally	3  3	33  56	19  32

<i>PRODUCTION OF MEAT.</i>			<i>Actual Increase Live weight lb.</i>	
Cockle Park, sheep grazing	10 cwt. slag applied on 3 occasions	21	87	300
Saxmundham, sheep grazing	10 cwt. slag applied on 2 occasions	11	62	83

The experiments quoted above were costed and in every case the expenditure on manures was amply covered by the value of the extra produce. The slags used were of the high-grade,



high-soluble type, *i.e.*, containing from 30-40 per cent. of phosphate, 80 per cent. or more soluble in citric acid. Under present conditions slags are often obtained containing only about 20 per cent. of phosphate. Some of these low-grade slags are as soluble as the old high-soluble slags, but others are distinctly less soluble in citric acid. It is often asked whether the same results can be expected from low-grade as from high-grade slags. A large amount of experimental evidence is accumulating on this point and the general indications are that the low-grade slags of high solubility are much the same in their action as the high-grade slags if applied at the same rate of phosphate per acre (*e.g.*, 10 cwt. of a 20 per cent. slag provides the same amount of phosphate as 5 cwt. of a 40 per cent. slag). The low-grade slags of low solubility have not usually come into action as quickly as the high-soluble types, and do best on peaty soils and in wet districts.

Potash can be applied to grass land more economically as muriate of potash or as the crude potash salts (kainit, sylvinite, etc.) than as sulphate of potash. The salts of soda, and in some cases of magnesia, which are introduced with the potash in the crude salts, are valuable on grass land; and the potash itself is purchased at a lower unit price than in sulphate of potash. A rough scale of equivalent quantities of potash is:—

1 cwt. sulphate of potash	=	1 cwt. muriate of potash.
" " "	=	1 $\frac{2}{3}$ cwt. 30-per cent. potash salts.
" " "	=	2 $\frac{1}{2}$ cwt. 20-per cent. French extra kainit.
" " "	=	4 cwt. 12 $\frac{1}{2}$ -per cent. kainit.

**Prices of Potash Manures.**—There have recently been considerable differences in the unit value of potash in the various potash manures now available. These values are obtained by dividing the price of the manure per ton by the percentage of potash contained, and represent the price of one-hundredth part of a ton (22.4 lb.) of pure potash (reckoned as  $K_2O$ ) when bought in the form in question. Thus muriate of potash containing 50 per cent. of pure potash has recently been quoted at £7 15s. 0d. per ton f.o.r. in London in 2-ton lots for cash. The unit value of potash in this form is therefore  $\frac{1.55}{50} = 3/1$ .

When figures obtained in this way are used to compare potash manures in the same class, *i.e.*, containing similar amounts of potash in the same chemical form, they give a useful basis of valuation. The following were average prices in London for the week ending 5th December:—

<i>Manure.</i>	<i>Potash.</i>		<i>Price.</i>		<i>Cost per Unit</i>	
	Per cent.		Per ton.		in London.	
			£	s.	s.	d.
Kainit ... ..	12½	...	2	5	3	7
Kainit ... ..	14	..	2	10	3	7
Sylvinite ... ..	20	...	2	15	2	9
Potash salts ... ..	30	...	3	15	2	6
Potash salts ... ..	20	...	2	12	2	7
Muriate of potash ... ..	50	...	7	15	3	1
Sulphate of potash ... ..	48	...	10	15	4	6

Certain forms of potash, however, are not interchangeable under all conditions, and in many cases the respective properties of the alternatives should be taken into account as well as their unit prices. For example, 20-per cent. sylvinite is not as safe a manure for potatoes as sulphate of potash, and although it can be purchased at a cheaper unit price this would not be the deciding factor in buying. Some potash manures such as kainit and 20-per cent. sylvinite provide more common salt than those of higher grade and the salt is of value to mangolds and grass. Some, such as ordinary kainit, contain in addition to common salt some sulphate of magnesia which appears to have value under certain conditions.

The following are closely comparable within their sections on all crops and the unit values form a good guide on which to purchase:—

- (1) 12½-per cent. kainit and 14-per cent. kainit ;
- (2) 20-per cent. sylvinite, 20-per cent. potash salts, and 30-per cent. potash salts.

The following are closely comparable for all crops except potatoes and market garden crops:—

- (1) 50-per cent. muriate of potash and 48-per cent. sulphate of potash.

The following are roughly comparable within their sections on all crops, the unit values not being the only consideration, but should be regarded in the light of differences in composition between alternatives and of their different effects on special crops:—

- (1) 12½-per cent. kainit, 14-per cent. kainit, 20-per cent. sylvinite, 20-per cent. potash salts, and 30-per cent. potash salts.
- (2) 48-per cent. sulphate of potash, and 50-per cent. muriate of potash.

Of the lower grade manures it will be noticed that 30-per cent. potash salts are offered at an attractive unit price; and muriate of potash is also cheap and deserves attention in cases where it has been decided not to use sulphate of potash for potatoes, or where a concentrated potash manure is wanted for a mixture for cereals.



The most useful unit values from the farmer's point of view are calculated on the cost of the manures when delivered on the farm. These are obtained by adding to the f.o.r. quotations the approximate charges for carriage and cartage (or to quotations at the farmer's station, the cost of cartage): the price per ton on the farm is then divided by the percentage of the constituent in question.

**Basic Slag or Lime?**—Farmers often ask whether it is necessary to use lime on their land if the phosphates are supplied as basic slag. Slags contain a small amount of chalk and free lime, and also a larger amount of calcium silicate which has the same effect as chalk in the soil. The quantities of these substances vary in different slags, but the following rough figures calculated as chalk give an idea of what is usually found :—

<i>Present in Basic Slag.</i>				<i>Equivalent Calculated as Chalk.</i>			
Chalk	}	...	...	...	...	5 per cent.	
Quick lime							
Calcium silicate		...	...	...	...	45	„
				Total	...	50	„

It will be seen that when slag is used an amount of basic material is left in the soil, which, reckoned as chalk, is equal in weight to about half the slag applied. By far the greater part of this is provided by the calcium silicate contained in the slag. Much arable land which is slightly sour, and carries poor crops in consequence, has a lime requirement of about 30 cwt. of chalk per acre. To sweeten such land by the application of basic slag is quite impracticable. If, for example, in a four-course rotation 6 cwt. of slag is applied to roots and a further 6 cwt. to clover, slag is being given at the rate of 3 cwt., and chalk equivalent at the rate of about  $1\frac{1}{2}$  cwt. per acre per annum. Dressings at this rate are not only insufficient to counteract even a slight degree of acidity, but will not supply enough chalk to replace the annual wastage through drainage and the interaction with artificial manures, which is estimated to be at least 5 cwt. of chalk per acre. One of the few advantages of using low-grade basic slags is that, in applying heavy dressings in order to provide the necessary phosphate, correspondingly large amounts of chalk are being restored to the soil.

**Liquid Manure.**—On farms where there are facilities for collecting liquid manure an application may be given to grass land at this time of the year. The liquid, consisting of the

drainage from cow houses, stables, and manure yards diluted with rain water, is of very variable composition but has considerable manurial value, and its constituents are present in a readily available form.

As an average of 35 samples collected from Scotch farms Hendrick found that 1,000 gallons ( $4\frac{1}{2}$  tons) of the liquid contained :—

	<i>lb.</i>	<i>Equivalent to lb.</i>	<i>Approximate value.</i>
Nitrogen (chiefly as ammonium salts)	20	100 Sulphate of ammonia	12s.
Phosphoric acid...	3	—	—
Potash ...	46	3 cwt. Kainit	7s.

Liquid manure is therefore relatively rich in potash and in nitrogen, but poor in phosphate, and against its manurial value of about 19s. per 1,000 gallons must be reckoned the labour involved in applying  $4\frac{1}{2}$  tons of liquid to the land. There is little risk of loss in applying liquid manure to grass land in winter. The potash is held in the soil till the plant can use it; while the nitrogen, being largely in the form of ammonium salts, is also held until it is converted into nitrate; when the soil is warm enough for this to occur the grass is also capable of growth and takes up most of the nitrate as it is formed. Liquid manure has given good results on meadow land, whether applied in December or early spring. It is usual to cart out the liquid at intervals during winter and spring as the tanks are filled, giving two or three dressings each of about 1,000 gallons per acre. Results obtained in Ireland, as an average of 54 experiments on the hay crop, show that two applications of liquid manure each of about 2,000 gallons, are as effective in the first crop as a heavy dressing of dung or a light and complete dressing of artificials.

<i>Manures per acre.</i>	<i>Hay (cwt. per acre).</i>
No manure ...	44
16 tons liquid manure (half in February, half in April) ...	60
16 tons dung ...	61
1 cwt. nitrate of soda ...	61
2 cwt. superphosphate ...	
2 cwt. kainit ...	

Liquid manure is also a valuable dressing for catch crops such as rye, oats and tares, etc., which are required to make quick growth in spring, for since they are usually taken on light



early land these crops respond well to a mixed nitrogenous and potash dressing of a quick acting kind.

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## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending December 5th.				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.) ... ..	13.15	13.15	13.10	13. 2	16.11
" " Lime (N. 13 per cent.) ... ..	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.13*	13.13*	13.13*	13.13*	(N)13. 2
" " " neutral (A. 25¾ per cent.)	14.16*	14.16*	14.16*	14.16*	(N)14. 0
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	2. 5	3. 7
" (Pot. 14 per cent.) ... ..	2. 7	2. 6	2.10	2.10	3. 7
Sylvinit (Pot. 20 per cent.) ... ..	...	...	...	2.15	2. 9
Potash Salts (Pot. 30 per cent.) ... ..	...	...	...	3.15	2. 6
" " (Pot. 20 per cent.) ... ..	...	...	...	2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 2	8.10	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	13.10	...	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.) ... ..	...	...	...	3.10§	2. 0
" " (T.P. 30 per cent.) ... ..	...	...	...	2.17§	1.11
" " (T.P. 26 per cent.) ... ..	2.13§	2. 0§	...	...	...
" " (T.P. 24 per cent.) ... ..	2. 9§	1.18§	2. 0§	...	...
" " (T.P. 20-22 per cent.) ... ..	...	1.13§	...	2. 5§	2. 3
" " (T.P. 18 per cent.) ... ..	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.13	...	3. 7§	3. 5	1.10
" (S.P. 30 per cent.) ... ..	3. 6	3. 2	3. 0§	3. 0	2. 0
Bone Meal (A. 4½. T.P. 45 per cent.) ...	9.10	8. 5	9. 0	8. 2	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6. 5	6. 5†	6.10	6. 5	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	...	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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## MONTHLY NOTES ON FEEDING STUFFS.

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*Animal Nutrition Institute, Cambridge University.*

**Brewery and Distillery By-Products.**—In the manufacture of beer, by-products arise which have a distinct feeding value for farm animals, and find a ready sale in most markets.

In beer brewing the barley is soaked in water, germinated and killed. The sprouts that are removed in the process are known as *malt culms*, the residual grain forming the malt of commerce. The malt is then digested in water, the liquid that results being separated from the grain residues, which are dried and form the dried brewers' grains. The liquid is then boiled with hops, cooled, and the hops separated. These *spent hops*, after drying, form the basis of several compound feeding stuffs now on the market. Spent hops, apart from a possible medicinal value, are of no value to the stock feeder. The filtered liquid is now fermented with yeast, cleared and is ready for casking or bottling. The yeast that arises finds its way on the market as brewers' yeast, and is a very valuable feeding stuff.

**Malt Culms.**—Malt culms contain 20 per cent. digestible crude protein, 12 per cent. of which is true protein, and has a starch value of 43.4. Its nutritive ratio is 1 : 3. A good sample should be dry, light yellow in colour and pleasant smelling. It is a good food for all classes of stock, and is easily digested. Malt culms are generally fed dry to horses, but are best soaked or scalded for other stock. They may be fed up to 6 lb. daily to horses, 3 lb. daily for cows and fattening cattle, up to  $\frac{3}{4}$  lb. to sheep, and up to  $1\frac{1}{2}$  lb. to pigs. Owing to the tendency of malt culms to become damp and go mouldy, care must be exercised to store them in a dry place.

**Brewers' Grains.**—Brewers' grains are of value for all classes of stock and can be fed wet or dry. In a wet condition the difficulty of cartage restricts their use to those farms situated near the brewery, except where special provision exists for keeping the grains. By means of cemented pits, and by the use of a little salt, brewers' grains may be kept in excellent condition for months, and pits of this description are in common use in the west country and in some parts of Kent. Dairy cows may be fed up to 30 lb. daily of the wet grains and pigs



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.						
	s.	lb.	s.	£ s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British - - -	—	—	10/3	10 5	0 16	9 9	71 6	2/8	1 43	
Barley, British Feeding - -	—	—	9/3	9 5	0 12	8 13	71	2/8	1 29	
„ Canadian No. 4 Western	32/-	400	9/-	9 0	0 12	8 8	71	2/4	1 25	
„ Persian - - -	30/6	400	8/6	8 10	0 12	7 18	71	2/3	1 20	
Oats, English, White - - -	—	—	10/6	10 10	0 14	9 16	59 5	3/4	1 78	
„ „ Black and Grey - - -	—	—	9/-	9 0	0 14	8 6	59 5	2/9	1 47	
„ Scotch, White - - -	—	—	10/6	10 10	0 14	9 16	59 5	3/4	1 78	
„ Canadian No. 2 Western	29/9	320	10/5	10 8	0 14	9 11	59 5	3/3	1 74	
„ „ No. 3 „ - - -	27/3	—	9/6	9 10	0 14	8 16	59 5	2/11	1 56	
„ American - - -	24/0	—	8/5	8 8	0 14	7 14	59 5	2/7	1 38	
Maize, Argentine - - -	42/-	480	9/10	9 17	0 13	9 4	81	2/3	1 20	
„ South African - - -	40/6	—	9/5	9 8	0 13	8 15	81	2/2	1 16	
Beans, Rangoon - - -	—	—	8/-	8 0	1 12†	6 8	67	1/11	1 03	
Peas, English, Maple - - -	—	—	14/6	14 10	1 8	13 2	69	3/10	2 05	
„ Japanese - - -	—	—	25/0	25 0	1 8	23 12	69	6/10	3 66	
Millers' Offals:—										
Bran, British - - -	—	—	—	7 5	1 7	5 18	45	2/7	1 38	
„ Broad - - -	—	—	—	8 5	1 7	6 18	45	3/1	1 65	
Middlings, Coarse, British - - -	—	—	—	8 10	1 2	7 8	64	2/4	1 25	
Meal, Barley - - -	—	—	—	10 5	0 12	9 13	71	2/9	1 47	
„ Maize - - -	—	—	—	11 0	0 13	10 7	81	2/7	1 38	
„ „ S. African - - -	—	—	—	9 2	0 13†	8 9	81	2/1	1 12	
„ „ Germ - - -	—	—	—	10 10	0 19	9 11	85 3	2/3	1 20	
„ „ Gluten-feed - - -	—	—	—	8 15	1 7	7 8	75 6	1/11	1 03	
„ Locust Bean - - -	—	—	—	8 10	0 9	8 1	71 4	2/3	1 20	
„ Bean - - -	—	—	—	12 10	1 12	10 18	67	3/3	1 74	
„ Fish - - -	—	—	—	20 0	4 6	15 14	53	5/11	3 17	
Linseed - - -	—	—	—	23 5	1 11	21 14	119	3/8	1 96	
„ Cake, English 9% Oil - - -	—	—	—	14 0	1 18	12 2	74	3/3	1 74	
Soya Bean Cake 6% Oil - - -	—	—	—	12 0	2 14	9 6	69	2/8	1 43	
Cottonseed Cake, English 5½% Oil - - -	—	—	—	8 2	1 15	6 7	42	3/-	1 61	
„ „ Egyptian 5½% Oil - - -	—	—	—	7 17	1 15	6 2	42	2/11	1 56	
Decorticated Cotton Seed Meal 7% Oil - - -	—	—	—	13 10	2 14†	10 16	71	3/1	1 65	
Coconut Cake 6% Oil - - -	—	—	—	9 10	1 11	7 19	73	2/2	1 16	
Palm Kernel Cake 6% Oil - - -	—	—	—	6 12	1 3†	5 9	75	1/5	0 76	
Palm Kernal Meal 2% Oil - - -	—	—	—	5 12	1 4	4 8	71 3	1 3	0 67	
Feeding Treacle - - -	—	—	—	6 15	0 8	6 7	51	2/6	1 34	
Brewers' Grains:—										
Dried Ale - - -	—	—	—	8 2	1 4	6 18	49	2/10	1 52	
„ Porter - - -	—	—	—	7 12	1 4	6 8	49	2/7	1 38	
Wet Ale - - -	—	—	—	1 16	0 9	1 7	15	1/10	0 98	
„ Porter - - -	—	—	—	1 13	0 9	1 4	15	1/7	0 85	
Malt Culms - - -	—	—	—	7 10	1 14†	5 16	43	2/8	1 43	

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 11s. per ton. The food value per ton is therefore £8 9s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22 4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1 25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 2d.; P<sub>2</sub>O<sub>5</sub>, 4s.; K<sub>2</sub>O, 2s. 6d.

may be given up to  $2\frac{1}{2}$  lb. per 100 lb. live weight. It is not customary to feed wet grains to other classes of stock than pigs and cows.

Dry brewers' grains, which contain 13 per cent. digestible protein, have a nutritive ratio of 1:4 and a starch equivalent of 48.3. With horses, half the oat ration may be replaced by dried grains with advantage, sheep may be given up to 1 lb. daily, and cows and fattening cattle may be given up to 6 lb. daily. Dried grains contain too much fibre to render their use with pigs profitable.

**Dried Yeast.**—Brewers' yeast in a dried form is a valuable feeding stuff. The wet yeast is dried on rollers, and comes off in the form of reddish brown light flakes. Dried yeast is a protein-rich feeding stuff, and contains 42 per cent. digestible protein, has a nutritive ratio of 1:1, and a starch equivalent of 67.2. It is of particular value for young growing stock. Owing to its richness in protein it should never constitute more than 10 per cent. of the total meals or cakes fed in the ration. It is inadvisable to mix it with sugary foods, unless a guarantee has been given that the process of manufacture has resulted in the death of the enzyme which causes fermentation to set up when yeast is added to sugary materials.

#### FARM VALUES.

CROPS.	Market Value per		Value per unit S.F.	Starch Equivalent per 100 lb.	Food Value per		Manurial Value per		Value per	
	lb. S.F.				Ton.		Ton.		Ton on Farm.	
	d.				£ s.		£ s.		£ s.	
Wheat - - - - -	1.16	2 2	71.6	7 15	0 16	8 11				
Oats - - - - -	1.16	2 2	59.5	6 9	0 14	7 3				
Barley - - - - -	1.16	2 2	71.0	7 14	0 12	8 6				
Potatoes - - - - -	1.16	2 2	18.0	1 19	0 4	2 3				
Swedes - - - - -	1.16	2 2	7.0	0 15	0 2	0 17				
Mangolds - - - - -	1.16	2 2	6.0	0 13	0 3	0 16				
Good Meadow Hay - - -	1.52	2 10	31.0	4 8	0 14	5 2				
Good Oat Straw - - -	1.52	2 10	17.0	2 8	0 7	2 15				
Good Clover Hay - - -	1.52	2 10	32.0	4 11	1 0	5 11				
Vetch and Oat Silage - -	1.34	2 6	14.0	1 15	0 7	2 2				

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## JANUARY ON THE FARM.

J. R. BOND, M.Sc., N.D.A. (Hons.), M.B.E.,  
*Agricultural Organiser for Derbyshire.*

**Weather.**—January is usually the coldest month of the year. It has been in this month that the severest frosts have occurred, the Thames having been firmly frozen over on a number of occasions recorded in English history. Likewise the most memorable snowstorms have been experienced in the first few weeks of the year. The temperature of the air and of the top soil is for the greater part of the time below that at which appreciable plant growth can take place, and the duration of bright sunshine is at its minimum—about one-fifth of the figure for May. January is the middle period of what farmers call the dead season, when grass, corn and all other outdoor vegetation are practically at a standstill.

In recent winters the wetness of January weather has been more in evidence than its normal low temperature. In most districts the January rainfall is high compared with that of the next two months, and owing to this, coupled with the little evaporation that takes place at this season, the land usually lies wet and sodden, the arable unfit for tillage operations and the grass land too soft to permit carting on it. Short spells of cold dry weather or black frost are appreciated by farmers, but tradition condemns conditions mild enough to allow the grass to resume growth in this month.

**Sowing Wheat and Oats.**—November and—to the time of writing—December have not favoured sowing operations, and the area intended for winter cereals has not been completed. After the middle of January wheat seeding may be resumed at the first opportunity when the soil is dry enough. The ordinary winter varieties such as Standard Red and Victor may be sown in preference to spring wheats, but unfortunately there is no experimental evidence on which to base a recommendation of any particular variety for drilling at this time of the year.

The depth of sowing is an important factor affecting the success of corn sown during the colder months. Shallow covering ensures an earlier and thicker plant than is obtained with deep drilling, and the risk of throwing out by frost is reduced rather than increased. Birds often trouble late sowings, especially after the seed has sprouted; but taking all things into consideration it is unadvisable to drill deeper than is necessary just to cover the seed—a depth of about one inch should be aimed at.

Occasionally very good crops are obtained from January sowings. For instance, last year a friend of the writer's drilled Squarehead's Master on 17th January, adopting the advice as to shallow covering. In the previous season the land had grown early potatoes followed by a catch crop of marrow-stem kale. The wheat came well, stooled out thickly and was ready for cutting at the ordinary time; it was estimated at about 6 qr. per acre by the judges of a competition for which the farm was entered. Nevertheless it cannot be contended that January is a good sowing month for most parts of England; in many districts the risk of failure would be high and good results could be obtained only when the season happened to be unusually favourable. The lowest temperature at which wheat will germinate is  $37^{\circ}$  to  $39^{\circ}$  F., while the mean temperature in January at a selection of places is:—York  $37.9^{\circ}$ , Nottingham  $37.6^{\circ}$ , Cambridge,  $37.6^{\circ}$ , Llandudno  $41.4^{\circ}$  and Plymouth  $42.2^{\circ}$  F. The daily temperature fluctuates about  $5^{\circ}$  above and below the mean, so that normally growth could be only intermittent at most places during this month.

Only good bold seed should be used for sowing at a time when the food reserves in it are likely to be fully needed; and it is desirable to sow about a bushel per acre more than is necessary in October, not only because of the greater mortality but also because the January sowing has missed the tillering which goes on in the milder weather of October and early November.

It is an accepted principle in farm management that the first chance should be taken. This rule is applied to seeding operations in the old saw "Sow when you can and wait when you must." Accordingly many farmers will take any opportunity which dry weather may afford to sow winter oats this month. Winter oats require about one degree higher temperature for germination than wheat, and in districts where wheat may be sown in January winter oats are not commonly sown till February. In this connection it is perhaps noteworthy that greys are hardier than blacks. As to the hardiness of the whites recently introduced, there is as yet little experimental evidence. In 1922 the writer saw a nice piece which had been sown in January, and last season a fairly good crop which had been sown in February.

**Ploughing.**—Leas intended to be followed by spring oats are very commonly ploughed in January. Where broadcasting is practised, the lea furrow is turned with a long breast and the



ordinary dimensions of the slice are 8 in. by 5 in. In order that seed may not fall through the bottom of the seams and be lost, the work must be straight and of uniform depth—crooked or wavy slices do not fit together properly but leave crevices—and the furrows must be packed together. Where the ploughing has been well performed, the corn yields fully as well as drilled crops.

Where the corn following “seeds” is to be drilled, the ploughing may be performed more expeditiously with a digger or semi-digger. In this case also, since there is no need to preserve an “arras” or crest to provide covering for the seed, the turf can be better buried; and, where ploughing can be done earlier, the work need not be delayed till after Christmas for fear of the grass growing through the seams.

Corn stubbles still unploughed at this date are in most cases those of the last crop in the rotation and therefore coming green-crop or bare-fallow in 1924: the rules of good husbandry allow of the presence of a reasonable quantity of weeds at this stage in the cropping, as the land will be cleaned before another crop is sown. Stubbles intended to be bare-fallowed in 1924 are better left unploughed for another month or two, as in this case it is undesirable to obtain a frost mould. The stubbles intended for roots should, of course, be turned over as soon as practicable.

In dealing with a twitchy piece of land, particularly where the weedy growth is confined to the top few inches, there are, at this time of the year, two alternatives:—(1) To plough shallow, leaving the weeds near the surface with a view to their easier eradication in spring before a second and deeper ploughing; (2) To plough deeply, using a digger and large skim coulter, burying the weedy layer in the hope of killing and rotting it. The choice will be determined by conditions. On fairly heavy land the second method is preferable, partly because on heavy soils a second ploughing late in spring should be avoided, and partly because this class of work really does kill twitch on heavy land, provided that the ploughing is efficient in the matter of placing the weeds out of reach of light and air. On lighter land the second method would not be good, because the weeds would grow through the deepened layer and then be more difficult to extract. Also in this case a second ploughing does not hopelessly destroy the tilth: where moisture conditions will not allow of a second ploughing in

spring, the necessary depth of tilth can on light land be obtained by successive operations with the cultivator or spring tooth harrow.

**Boxing Seed of Late Potatoes.**—Second early and late varieties if not already bought should be ordered now, and the former should certainly be boxed by the end of the month. As regards late potatoes, boxing is not the rule, although it would seem that there is a good case for the extension of the practice. Timely boxing usually increases the yield of ware by about  $1\frac{1}{2}$  tons per acre; and, as “rogues” and “duds” are shown up by their sprouts or by the absence thereof, the crop planted with sprouted seed can be purer and more regular than it might otherwise be. Where planting was necessarily late, the advantage of proper and timely boxing might be  $2\frac{1}{2}$  tons per acre. On the other hand, with early planting, seed taken direct from the pit may yield almost as well as boxed seed. The virtue of boxing is not confined to the preservation of the first sprout; apparently the wilting of the setts in the boxes is advantageous.

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ONE of the chief characteristics of the London Dairy Show last October was the great display of special utensils and machinery designed to help in the production of Certified and other designated milk.

#### **Clean Milk Production.**

The view held by many authorities that such milk is to be the milk of the future received support from the fact that in the Main Hall of the Show in a very prominent position there was a Stand under the joint auspices of the Ministry of Agriculture, the British Dairy Farmers' Association and the National Institute for Research in Dairying, Reading. At this Stand three demonstrations were given daily with the object of showing not only to producers, but also to the general public, how Certified Milk is produced.

In England alone there are at present nearly 150 producers of Certified, Grade-A (Tuberculin-tested) and Grade-A milk. This number is gradually increasing and it is hoped that in course of time there will be available an ample supply of the very cleanest of raw milk. Farmers will produce it if the public demands it. Greater care, and incidentally greater expense, are needed for its production than for ordinary milk, and hence its cost to the consumer is somewhat higher, but since such milk will keep sweet, even in the hottest of weather, for a long period, it is in the end the cheapest milk to buy.



The Stand was divided into three sections. One section was allotted to two cows, the next represented the room where the washing and sterilising of utensils takes place, and the third where the milk is cooled and bottled. At each demonstration the essentials of clean milk production were carefully explained.

Special buildings and stall fittings are sometimes an advantage, but cleanliness in all things must be the watchword; without cleanliness Certified Milk cannot be produced. The cow must be both clean and healthy, and the cowshed clean, well ventilated and well lighted, for sunlight kills germs. The flanks and udder of each cow should first be washed and then wiped with a clean cloth. The milkers must be scrupulously clean; they must wash their hands before milking and milk with dry hands. A great advantage is the use of a Davis or similar small-mouthed milking pail, into which dust is less liable to fall than into the ordinary pail. Immediately after milking the milk should be removed from the cowshed to the dairy, and there strained and cooled to as low a temperature as possible. It should then be run into bottles, which have previously been sterilised; these should then be capped and sealed and kept in a cool room. All utensils must be carefully washed and then sterilised. They should be sterilised again immediately before use.

While all this was being carefully explained by the Demonstrator, the cows were milked, and the milk strained, cooled, and bottled, as would be done on a certified milk farm. Both the milker and dairymaid wore white overalls.

The growing popularity of this kind of milk was evidenced by the crowds that assembled in front of the Stand, some time before each demonstration was timed to take place. In the intervals, too, the demonstrator and his assistants, as well as the Ministry's representative, were assailed with questions dealing with the problems of producing Certified Milk.

This is a phase of dairy farming that has come to stay, and it is to be hoped that it will lead to a greater consumption of milk, especially by children. This, in turn, will improve the national health for, taking bulk for bulk, no other drink in the world contains so much nourishment as is to be found in milk.

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A COURSE of instruction in the production and handling of milk will be held at University College, Reading, from Wednesday, 30th January, to Saturday, 23rd February, 1924. The course is intended primarily for dairy instructors and instructresses, but other students will be admitted if the limited accommodation (24) will allow. Applications for admission to the course should be made in the first instance to the Dean, Faculty of Agriculture and Horticulture, University College, Reading, and intending students should be prepared to commence work at 9.0 a.m. on Wednesday, 30th January.

The fee for tuition for the three weeks will be £5, which must be paid to the College Office.

Lectures will be given on milk production and supply, chemical composition of milk, and diseases of cattle affecting milk supply; and demonstrations of practical bacteriology in connection with the handling of milk will be arranged. Excursions will be arranged to well-known dairy farms, factories and depôts, but the travelling expenses in connection therewith are not included in the tuition fee.

The College cannot undertake to arrange residence for students, but will give all possible assistance and advice thereon. Students are advised to take bicycles with them.

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CURIOSITY has been expressed as to a recent notice in the Press referring to a consignment of earwigs sent from this country to New Zealand to destroy bacteria.

#### **Insect Pest Control.**

Such a statement would probably fill the residents of New Zealand with misgiving, as the earwig is already a pest there to an extent unknown in this country. The truth is that the recent consignment to New Zealand consisted of the puparia of *parasites* of the earwig, and in some cases the earwigs themselves with the parasites inside them. These earwig parasites do not occur in New Zealand, and it is hoped that they will increase and multiply there at the earwigs' expense and so form a natural control of that pest. The earwig itself, being an insect which has been accidentally introduced into New Zealand, possesses no natural enemies sufficient to keep it in check and maintain a balance. Hence the need for the measures which are here outlined.

The earwig parasites are being bred and despatched to New Zealand by the Rothamsted Experimental Station, acting on



behalf of the Imperial Bureau of Entomology. This Institution is also breeding Ichneumon Fly parasites of the Pear Slug-worm for introduction into New Zealand.

Great Britain is receiving her share in the exchange of beneficial insects between countries. From a small amount of material received from France last spring, some thousands of cocoons of a Chalcid Fly known as *Aphelinus mali* have been raised at the Ministry of Agriculture's Pathological Laboratory at Harpenden for distribution to a few chosen places over the country next year, which will become distributing centres in their turn. This Chalcid Fly is a parasite of the Woolly Aphis or American Blight, against which, if it can be successfully established, it should prove a valuable controlling agent. The Fly was at first thought to confine its attentions entirely to Woolly Aphis, but from information recently received from other countries where its introduction has been accomplished, some other kinds of "greenfly" or aphides are falling a victim to it—a point which may add to its usefulness.

It is practically impossible to increase artificially the numbers of a beneficial insect which is either indigenous to, or has been long established in, this country, as its position in the insect world is stabilised; hence the reliance on new introductions. Our ladybirds are instances of very beneficial insects, which, however desirable it may be to increase them by artificial means, offer little hope of an attempt to do so being successful.

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THE Ministry of Agriculture and Fisheries (acting on behalf of the War Office) gives notice that a Show of Thoroughbred Stallions will be held, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, at the Royal Agricultural Hall, Islington, on March 4th, 5th and 6th, 1924.

**The London  
Thoroughbred  
Stallion Show  
for 1924.**

A Challenge Cup presented by H.M. The King will be awarded for the Champion Stallion in the Show; and a Gold Medal will be awarded by the Ministry to the owner. Sixty King's Premiums (including twelve Super-Premiums) will also be offered for award by the Ministry.

In addition to the King's Premiums, a very limited number of War Office Premiums will be available for award on the recommendation of the County Horse Breeding Committees.

These awards will not be made, however, until the routes of the King's Premium stallions have been arranged.

Copies of the Regulations governing the award of the Premiums can be had on application to the Ministry.

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THE Ministry has arranged for the collection of a set of lantern slides on poultry subjects for the use of county poultry instructors

**Lantern Slides on Poultry Subjects.** and others engaged in lecturing on poultry-keeping. Some 120 of the most important slides have already been made, and the series will be added to as opportunity occurs for securing suitable subjects.

Any of the slides can be obtained at 10d. each, and a list of the subjects illustrated will be sent to any poultry instructor desiring to purchase them. Explanatory notes in connection with these slides are being prepared by the Ministry and will be issued as soon as completed.

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**Foot-and-Mouth Disease.**—All restrictions imposed in connection with the outbreaks at Morden, Surrey; Dean, Beds; Withernsea and Bridlington, Yorks, have been withdrawn.

The areas in Bucks and Kent to which restrictions were applied on account of the outbreaks near Wendover and Birchington respectively have been contracted.

Statement as to the number of outbreaks of foot-and-mouth disease from 17th November to 12th December (inclusive).

<i>Counties.</i>		<i>Counties.</i>	
<i>England and Wales.</i>		Salop	33
Buckingham	1	Stafford	10
Chester	409	Warwick	3
Denbigh	30	Worcester	10
Derby	5	Yorks, N.R.	5
Durham	71	Yorks, W.R.	23
Flint	13	<i>Scotland.</i>	
Gloucester	30	Aberdeen	3
Kent	1	Ayr	3
Lancaster	17	Dumbarton	16
Leicester	7	Kinross	1
Lincs, Lindsey	1	Lanark	10
Monmouth	1	Perth	2
Northumberland	45	Renfrew	10
Nottingham	1	Stirling	5
		Total	766



*General Restrictions.*—Until the 22nd November, on which date the Ministry learnt of the infection of the Newcastle loading docks and market, the Ministry pursued its usual policy of imposing restrictions over a radius of 15 miles from any new centre, with extensions in the case of those centres in which the disease had spread. The danger of a widespread infection resulting from the infection at Newcastle rendered more drastic measures necessary, and on that date the Ministry made an Order entirely prohibiting the movement of stock into, within or through, a large area stretching from the Clyde to Thames and Severn, but excluding Wales. This Order was quickly modified so as to provide for necessary movements of animals by licence, and the holding of fat stock markets with veterinary inspection, the main objects being (a) to stop entirely all store stock markets, and (b) to prevent general long distance movements except under control.

On 1st December this Order was replaced by a new Order, the Great Britain (Foot-and-Mouth Disease) Order of 1923 (No. 5), which revoked all the existing Orders except the Scottish Orders and the North Midlands (Cheshire group) Orders, and divided the area to which restrictions were applied on the 22nd November into (a) 11 infected areas surrounding the actual centres of disease, and (b) a controlled area comprising the remainder of the district subject to the Great Britain Order.

Provision was made in this new Order for the movement by licence of the Local Authority into and within these areas of store as well as fat stock to supply the needs of the population and of the farmers, but no movement was allowed out of the infected areas. Markets and sales were, as before, confined to fat stock intended for immediate slaughter and to displensing sales of animals on farm premises. No licence was permitted to be granted under the Orders for any movement within two miles of an infected place and no fat stock market was allowed to be held within 5 miles of infected premises. Subsequently movement of fat stock only was permitted from one Infected Area to a slaughterhouse in another Infected Area.

In view of the freedom of the greater part of the Controlled Area from outbreaks of the disease, it was decided to remove all restrictions therefrom as from the 15th December.

*Imported Animals.*—It was also considered desirable as a precautionary measure to prevent the risk of the spread of disease from store markets by the movement of imported animals from market to market to provide that no licence shall be granted for the movement of imported animals direct to an authorised market from a landing place, but only (1) direct to a slaughterhouse or (2) direct to private premises for detention thereon for a period of fourteen days, instead of for the period of six days prescribed by the previously existing Orders. This was effected by the Imported Animals Order of 1923, which came into force on the 19th November.

*Summary.*—The number of outbreaks from the period 27th August to the 12th December now totals 1,074, affecting 28 counties in England, 2 in Wales, and 9 in Scotland.

The numbers of animals slaughtered, or authorised to be slaughtered, to 12th December were 35,323 Cattle, 16,283 Sheep, 19,448 Pigs and 31 Goats.

## AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1923.

### PRODUCE OF CROPS.

The following PRELIMINARY STATEMENT issued on 24th November last shows the estimated total produce and yield per acre of the POTATO and ROOT CROPS in England and Wales in 1923, with comparisons for 1922, and the average yield per acre of the ten years 1913-1922.

Crops.	Estimated Total Produce.		Acreage.		Estimated Yield per Acre.		Average of the Ten Years 1913-22.
	1923.	1922.	1923.	1922.	1923	1922.	
	<i>Tons.</i>	<i>Tons.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Potatoes -	2,756,000	4,012,000	466,653	561,177	5·9	7·1	6·2
Turnips &							
Swedes -	10,828,000	10,908,000	858,429	819,686	12·6	13·3	12·4
Mangolds -	6,956,000	8,560,000	401,447	421,388	17·3	20·3	18·9

*Potatoes.*—Potato planting was rather late in 1923 as spring work generally had been delayed by rainy weather and the difficulty in working heavy land. Planting was done with the soil cold and the crop came up slowly, whilst earlies were cut by May frosts in most parts of the country. The weather early in the season was not very favourable to growth, but the rains of August and September were beneficial. In the north-west and in Wales, however, the continuous autumn rains caused many tubers to rot before lifting. Most of the crop has been stored in dirty condition, but the quality is fairly good as a rule, though the tubers are small. The total production of potatoes on agricultural holdings in England and Wales is estimated at 2,756,000 tons, as compared with 4,012,000 tons last year, and 2,958,000 tons in the very dry year 1921. The average yield per acre is estimated at 5·9 tons, or  $1\frac{1}{4}$  tons less than the very high figure of last year, and one-third of a ton below the average of the ten years, 1913-22. Yields are below average in most counties, but of the chief potato-growing districts Lancashire has the most unsatisfactory crops, the yield in that county being one ton below average. In the Holland division of Lincolnshire and in the Isle of Ely yields were only one-fifth of a ton below average.

*Turnips and Swedes.*—The dry spell of weather in June and July, which was experienced in most parts of the country, had a bad effect on turnips and swedes. Sowings of turnips were delayed in many districts and plants of swedes and turnips were often patchy, while in a few districts there were many complete failures. In the north conditions were more favourable and a good plant was obtained. Very fair growth was made in the late summer and autumn, but in the eastern and midland counties swedes suffered from mildew. The average yield over the whole country is estimated at 12·6 tons per acre, which is three-fourths of a ton less than last year, but one-fifth of a ton above average. Crops are well over average in the north, and poorest in Oxford, Essex and West Suffolk, where there were many complete failures. The estimated total production of 10,828,000 tons is very little less than last year, the acreage having been increased.



*Mangolds.*—The sowing of mangolds was late owing to the land requiring much work to obtain a satisfactory seed bed, and germination, though usually regular, was slow. After coming through, the plant remained almost at a standstill for some weeks, as a result of the cold weather, and continued backward throughout the season, so that the roots are small. An unusually large proportion ran to seed. Yields are light in all parts of the country, but are relatively poorest in the north and south-west. The average yield per acre over the whole country is estimated at 17·3 tons, or  $1\frac{2}{3}$  tons under average, and 3 tons less than last year, whilst the estimated total production, 6,956,000 tons, compares with 8,560,000 tons in 1922, and 7,583,000 tons the average of the ten years, 1913–22.

In most districts supplies of winter keep for live stock will be sufficient, any shortage of roots being counterbalanced by the large stocks of hay. In the hill districts of Wales and the north-west of England the position is not satisfactory, as in these areas supplies of hay are short, much of the crop being spoiled by the wet weather and large areas were never cut.

**Dairy Exhibition at Milan.**—A notice was issued in October last, that an exhibition under the auspices of the Italian Government would take place in Milan in November. The Exhibition was to include all the products of milk, and types of machines, utensils and other articles used in connection with the dairy industry.

The Ministry of Agriculture is informed that the Exhibition has been postponed until April, 1924. The postponement is due in part to the desire of American exhibitors, who were recently occupied with a similar Exhibition at Washington, to be represented at the Milan Exhibition.

British firms who may wish to participate should address their inquiries and applications to the Direzione Generale, Via Tigli 7, Milan, Italy.

**Agricultural Machinery Exhibition, Brussels, 1924.**—The eleventh agricultural machinery exhibition organised by the Société de Mécanique et d'Industries Agricoles will be held at Brussels from 16th to 25th February, 1924.

The exhibition will include cultivating, harvesting and food-preparing machinery; milking machines and dairy equipment; land improvement machinery, *i.e.*, drainage, levelling and clearing; forestry appliances; equipment for rural industries; tractors and other agricultural engines and accessories; rural building materials and architecture; small tools and harness; and the application of electricity to the farm.

**Fictitious Claims for Fertilisers.**—A certain amount of interest has recently been aroused by the report of a discovery in France of a new fertiliser, applicable to both cereals and roots, for which results bordering on the marvellous are claimed. The process, according to reports, consists in steeping the seeds before sowing in a solution, the composition of which is not revealed; and it has been stated that the process has been approved by the French Government. This statement is entirely without foundation. The French Ministry of Agriculture has recently issued a note warning farmers and others interested in agriculture to be on their guard against claims of this nature. It points out that the common sense of agriculturists has generally stood them in good stead in estimating the value of advertisements, while they

may always, if any doubt arises, seek the advice of Research Institutes, or of the local advisory centres. The warning thus addressed to French farmers is passed on in the same terms to farmers in this country.

**International Dairy Exhibition in Argentina.**—An International Dairy and Refrigerating Machinery Exhibition will be held at Buenos Aires in May, 1924, organised by the Argentine Department of Agriculture. Space will be free of charge to exhibitors, and all machinery, implements and general merchandise for exhibition will be free of customs, entries or fees, but exhibitors must arrange their own fixtures and equipment. A copy of the prospectus may be seen at the offices of this Ministry.

The Commercial Secretary to H.M. Legation at Buenos Aires reports to the Department of Overseas Trade that these exhibitions are successful from the local exhibitor's point of view, as they provide useful propaganda at a moderate cost. He considers that there is justification in encouraging British manufacturers to take part when they have local importers or representatives who carry local stocks of suitable machinery and implements which are available for exhibition, or to whom they are prepared to ship suitable specimens for the purpose, and when the importer or representative recommends participation.

**Import Regulations as to Plants, Potatoes and Tomatoes from France.**—The Ministry has issued an amended Order (The Colorado Beetle Order of 1923) in place of the Order which was made in 1922, with the object of preventing the introduction of this pest from France.

The effect of this new Order is that in place of the declaration formerly required, each consignment of living plants, potatoes or tomatoes shipped from ports in European France to this country must be accompanied by the under-mentioned certificate or copy certificates :—

- (1) *If grown in France.* (a) For potatoes and for all plants which are subject to the Destructive Insects and Pests Order of 1922, the copy certificates required under that Order. These certificates must be officially endorsed to the effect that the produce was not grown in the neighbourhood of those districts where the Colorado Beetle has existed.  
(b) For tomatoes and for plants which are not subject to the Destructive Insects and Pests Order of 1922, an official certificate to the effect that the produce was not grown in the neighbourhood of those districts where Colorado Beetle has existed.
- (2) *If grown in other countries and shipped from European French Ports.*—Either the copy certificates required under the Destructive Insects and Pests Order of 1922, or a certificate of origin visé by a Local Authority in the country of origin; the country and place where the produce was grown must be stated in the certificates.

The certificate or copy certificate must be delivered to an Officer of Customs at the same time as the entry relating to the consignment. In the event of failure to produce the necessary document, a consignment must be destroyed or re-exported by and at the expense of the importer unless its disposal is otherwise authorised by the Ministry.

No certificate or declaration of any kind is now required in the case of vegetables for consumption other than potatoes or tomatoes. The Order came into operation on the 17th December, 1923.



**Importation of Plants into Canada.**—Nurserymen and others interested in the trade in plants to Canada are doubtless aware that nursery stock may only be imported into that Dominion under permit issued by the Dominion Government. These Permits are issued to the Importers in Canada, and the Ministry is informed that it is unnecessary that a permit be forwarded to this country for return with the consignment to which it relates. The Canadian importer should, however, notify the English exporter of the number of the relative permit and this number should be marked on each container. By adopting this course the entry of consignments into the Dominion will be facilitated.

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## REPLIES TO CORRESPONDENTS.

**Algerian Phosphate for Wheat.**—J.K. asks for information as to the value of ground Algerian phosphate applied to wheat at the rate of 5 cwt. per acre a fortnight before sowing.

*Reply:* As the phosphate in Algerian phosphate is not soluble in water it could not necessarily be depended on to become available in a sufficiently short time to be of much benefit to the crop. Its availability would be enhanced (1) by extra fineness of grinding; (2) if there were a heavy rainfall; and (3) if the soil were sour. This last condition, however, would be adverse to wheat. Leaflet No. 80 expresses a distinct preference for superphosphate for corn crops, and 3 cwt. of superphosphate would probably prove both cheaper and more effective.

**Cowpeas.**—L.M. asks whether cowpeas have been tried in England.

*Reply:* There is no information available as to any actual trials. It is not probable that the crop would succeed in this country.

**Thermo-Gen System of Paper Mulching.**—N.O. asks for information.

*Reply:* The method of using paper for mulching, as practised in Honolulu, is described in the Queensland Agricultural Journal, Vol. XVIII, p. 293 (October, 1922), and in the Indian Scientific Agriculturist, Vol. IV, p. 186 (May, 1923). From the former it is gathered that the system has been patented, from the latter, that "Pabco Thermo-Gen is an asphalt-impregnated felt." So far as can be ascertained the system has not been tried in this country.

**Plants for Hedges.**—P.Q. asks for suitable quick-growing plants for hedges.

*Reply:* Thorn would be suitable if a quick-growing hedge to keep out cattle is required. If an evergreen hedge is needed, privet (*Ligustrum ovalifolium*) should be planted. *Berberis stenophylla* would be suitable if an evergreen flowering hedge is required.

**Analyses of Cooked and Raw Potatoes.**—R.S. asks whether the figures given in the Ministry's Miscellaneous Publication No. 32 refer to raw or cooked potatoes.

*Reply:* They refer to raw potatoes. Similar figures for cooked potatoes are not available, but no serious error will result if the figures for raw potatoes

are used. The figures given for roots refer, in every case, to roots in the raw state.

**Pig-Feeding in Denmark.**—T.U. asks for information.

*Reply*: The Ministry does not know of any book in English which would give the information. Methods of feeding generally adopted in Denmark apparently vary according to circumstances, but skimmed milk or whey, a supply of which is afforded by the dairying industry, seems always, or practically always, to form part of the ration. As regards the feeding at the Experimental Stations for Pigs the information in the note below, taken from the 9th and 11th reports of these stations, was enclosed:—

*Bregentved, 1st September, 1916—31st August, 1917.*—Concentrated food, first half-year, barley and maize, half of each; the small pigs got only barley.

**Pig Feeding at Danish Breeding Centres.** In the second half-year, owing to shortness of supplies, no barley was available, and about  $\frac{3}{4}$  maize and  $\frac{1}{4}$  coconut cake was used. As liquid food only skimmed milk was used up to 4.5 kilo. (say 10 lb. or 1 gallon)

per pig per day. If this amount was not enough to moisten the concentrated food water was added so as to preserve a proportion between solid and wet food of 1 : 2. A little bone meal was also given. The small pigs are given their concentrated food dry (finely crushed); later they go on to wet food. The pigs are given as much as they will eat, but they must eat readily. If a pen leaves its food, it has to go without for one or two feeding times.

*Bregentved, 1st September, 1921—31st August, 1922.*—Much the same as above. Small pigs under 30 kilo. (say 66 lb.) only get barley. Skimmed milk reduced to 3 kilo. (say  $\frac{2}{3}$  gall.)

*Elsesminde, 1st September, 1916—31st August, 1917.*—Less milk was given to the older pigs, but all got the same proportion—1 concentrated food to 2.5 skimmed milk or skimmed milk and water. In the case of the big pigs in Class IV, receiving 3 kilo. food units\* or over daily, the liquid food remained always the same (5.4 kilo. daily of equal proportions of skimmed milk and water) and the weekly increase was given in the form of concentrated food.

*Percentage Composition of Food.*

			<i>Food calculated in Food Units.</i>	
			<i>Concentrated.</i>	<i>Skimmed Milk.</i>
			p. c.	p. c.
Class I	Under 25 kg. (55 lb.)	...	70	30
"	II From 25–40 kg. (55–88 lb.)	...	75	25
"	III From 40–55 kg. (88–121)	...	80	20
"	IV Over 55 kg. (121 lb.)	...	85	15

The food is mixed and allowed to stand about 24 hours before feeding. About 25–50 grammes (0.8–1.6 oz.) of bone meal per pig per day.

*Elsesminde, 1st September, 1921—31st August, 1922.*—More or less as above. But the classes in the table are slightly different, the food proportions not being altered. Class II from 25 to 45 kilo.; Class III from 45–65 kilo.; Class IV over 65 kilo.

It is noted that the pigs must clear up all the food at each feeding time:—6 a.m., 11.30 a.m. and 5.30 p.m.

*Oer Løjstrup (Jutland), 1st September, 1916—31st August, 1917.*—The food in previous years consisted of skimmed milk and of equal parts of barley

\* A kilogramme food unit is the equivalent of 1 kilog. (2.2 lb.) of barley.



and maize; this year both milk and barley were short. To avoid giving nothing but maize, coconut cake was used (80 p. c. maize and 20 p. c. coconut cake).

Coconut cake in other trials had been shown to have a favourable effect on the firmness of the flesh, and so counteracted the maize. The young pigs did rather badly on a diet including too much maize.

*Over Løjstrup (Jutland), 1st September, 1921—31st August, 1922.*—No special notes on the feeding for this year are given. The following paragraph, however, occurs:—The shortness of the harvest of 1921 had the effect that the pigs suffered somewhat from want of bedding; added to this was the severe period of frost in January and February. The result was that the pigs suffered from cramp; as soon as this appeared all the pigs in the station were given a dose of "phosphoric oil"; this was so effective that scarcely a single pig suffered any lasting result from the complaint.

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## NOTICES OF BOOKS.

**International Year Book of Agricultural Statistics.**—(*Copies can be obtained direct from the International Institute of Agriculture, Rome; or from the Ministry of Agriculture, 10, Whitehall Place, London, S.W.1., price 8s. post free.*)—The International Institute of Agriculture at Rome has recently issued the "International Year Book of Agricultural Statistics, 1922." Various changes have been made in the volume consequent on a decision to make it a regular annual publication, the previous issues having appeared at longer intervals. Figures are given for the years 1922, 1921, 1920 and 1919, and instead of the averages for the years 1914-1918, those for the years 1909-13 have been substituted, as affording a more satisfactory basis of comparison than the figures of the war period. The volume includes data showing for each country—(1) area and population; (2) acreage, production and yield of the principal crops; (3) number of live stock; (4) imports and exports of the various agricultural products; (5) prices of agricultural products; (6) freight of cereals and cotton; and (7) production of fertilisers.

**Insecticides, Fungicides and Appliances.**—(O. G. Anderson and F. C. Roth. London: Chapman and Hall. 15s. net.) The first 175 pages of this book are devoted to a series of laboratory exercises for students taking a course in insecticides and fungicides at an American Agricultural College. They will hardly prove of interest to English growers, except perhaps as evidence of the thorough manner in which the subject of pest control is approached in the United States.

The last 175 pages are given to a general discussion of spraying and spray appliances, which should prove useful to those who are following the development of the subject in the United States, especially perhaps to any who may be tempted to test American methods under English conditions. Fruit-growing periodicals from across the Atlantic are now widely read in England and the glowing accounts published of new methods are apt to be misleading to those accustomed to the sober phraseology of the English Press. The present book carefully avoids such misplaced enthusiasm. For instance, those testing the spray gun on low power outfits will be interested in the

statement (p. 239) that an engine of at least  $3\frac{1}{2}$  h.p. is necessary to operate one gun, while for two guns, 10 h.p. is desirable, since the minimum working pressure is 250lb. And again, as regards dusting (p. 300):—"The prevalence of dusting among fruit growers in the State of New York varies from  $\frac{1}{8}$  of 1 per cent. to 5 per cent. . . . Probably the dusting of fruit is more prevalent in New York than in other portions of the United States. . . .

"Dusting is still in the developmental stage and with continued improvement in materials and equipment may have greater possibilities in the future than at present. Present indications are that the future possibilities for dusting may be somewhat greater for low-growing crops than for tall trees."

The book is published by John Wiley & Sons of New York and may be obtained from Messrs. Chapman & Hall, Henrietta Street, at a price of 15s.

**Successful Spraying, and How to achieve it.**—(P. J. Fryer, F.C.S., F.I.C. London: Ernest Benn, Ltd., 1923, 154 pp., 7s. 6d. net.) This is a handbook for growers, nurserymen, horticulturists, gardeners and amateurs, dealing chiefly with a consideration of the insect pests and fungus diseases of fruit trees and their control.

The author describes the principles of "Contact" sprays for sucking insects and "Stomach poisons" for biting insects.

"Wetting" agents, water properties and the chemistry of spraying are also considered.

A description is given of the more modern hand and power spraying appliances, a short chapter on fumigation, and the work concludes with a summary of the chief insect pests and fungus diseases of fruit trees and small fruit, with suggestions for their individual control.

The book is illustrated with a number of photographs and text figures.

**Die Lupine als Objekt der Pflanzenforschung.**—(F. Boas and F. Merckenschlager. Berlin: Paul Parey, 1923. 144 pp. 63 illustrations.) This book has a manifold object. It takes the lupin as a text for a description of the processes which take place in the life of a plant, in much the same way as Dr. D. H. Scott used the wallflower in Part I of "Structural Botany." The monograph is also designed to satisfy the increasing interest with which the plant is being regarded by the farmer. In this latter connection there are chapters on the lupin as a collector of nitrogen and carbon dioxide, its use as a soil improver, and its economic value. Copious references and a full index enhance the value of the volume.

**Le Soja et son Lait végétal.**—(L. Rouest. Carcassonne and Paris, Librairie des Sciences Agricoles, 1921. 157 pp., 8 illustrations, 10 francs.) Whether the cultivation of the soya bean for its seed in this country will ever, under normal climatic conditions, become a possibility is extremely doubtful. Those, however, who wish to attempt to find a successful solution to the problem will gain a considerable amount of assistance from this small volume, which gives an account of the work that has been done in France in this direction.

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## ADDITIONS TO THE LIBRARY.

### Dairying.

- Canada Department of Agriculture.*—Bulletin 34 (New Series):—Dairying in New Zealand and Australia. (33 pp.) Ottawa, 1923. [63.7(9).]  
*Texas Agricultural Experiment Station.*—Circular 30:—The Practicability of the Milking Machine. (23 pp.) Brazos County, 1923. [63.713].  
*Nebraska Agricultural Experimental Station.*—Bulletin 181:—Growth Studies of Dairy Heifers II. Protein Requirements for Growing Heifers. (18 pp.) Lincoln, 1923. [63.711(04).]

### Poultry.

- Roberts, H. A.*—Commercial Poultry Raising. (607 pp.) London: Chapman & Hall, 1923, 15s. net. [63.65(02).]  
*Evans, E.*—The Biology of the Fowl. (160 pp.) The Author, 21, Rydal St., Burnley, 1923, 7s. [63.651(02).]  
*Hardy, F. W.*—The Chemistry of Food: A Manual for Poultry Keepers. (47 pp.) London: National Utility Poultry Society, 1923, 2s. [612.394; 63.65 : 043.]

### Engineering.

- Cleghorne, W. S. H.*—Farm Buildings and Building Construction in South Africa. Second Edition. (360 pp.) London: Longmans, Green & Co., 1922, 25s. [69(02).]  
*Purvis, G. H.*—Agricultural Implements. (115 pp.) [Successful Farming Series.] London: Ernest Benn, Ltd., 1923, 2s. 6d. [63.17(04).]

### Economics.

- Pigou, A. C.*—Essays in Applied Economics. (200 pp.) London: P. S. King, 1923, 10s. 6d. net. [33(02).]  
*Gardiner, R. S., Central Land Owners' Association.*—The Agricultural Landowners' Handbook on Taxes, Rates and Tithe. (110 pp.) London: Estates Gazette, 1923, 3s. net. [336.22; 348].  
*Institute International d'Agriculture.*—Reglementation des Prix de vente des Produits agricoles. (79 pp.) Rome, 1923, Fr. 5. [338.5; 338.99.]

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- The Periodicity of Meteorological Factors in Relation to Agriculture, *F. Eredia*. (Int. Rev. Sci. & Pract. Agr., 1923, No. 3, pp. 587-594.) [551.5].  
 Danish Experiments in Plant Culture and details about the Trade in Controlled Danish Seed. (Tidsskr. Planteavl, XXIX (1923), 4, pp. 667-672.) [575.4; 63.1951].  
 Investigations on the Solubility of Various Phosphates, *H. R. Christensen*. (Tidsskr. Planteavl, XXIX (1923), 4 pp. 513-574.) [63.1672].  
 Nitrates and Ammonia from Atmospheric Nitrogen, *E. K. Scott*. (Jour. Roy Soc. Arts, Nov., 1923, pp. 859-895.) [668.6].

### Field Crops.

- The Growing of Crops for Silage and some Experimental Results, *J. P. Drew*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 144-157.) [63.19832].  
 A Study of Factors Affecting the Nitrogen Content of Wheat and of the Changes that Occur during the Development of Wheat, *G. A. Olson*. (Jour. Agr. Res., XXIV, 11, June 16, 1923, pp. 939-953.) [63.311].  
 The Water Content of Barley Kernels during Growth and Maturation, *H. V. Harlan and N. P. Merrett*. (Jour. Agr. Res., XXIII (1923), pp. 333-360.) [63.313].  
 Further Studies on Seed Potato Treatment, *J. C. Gilman and J. E. Melhus*. (Phytopath, XIII (1923), 8, pp. 341-358.) [63.512].

### Horticulture.

- Commercial Horticulture in Scotland, *D. V. Howell*. (Scottish Jour. Agr., VI, 4, Oct., 1923, pp. 402-413.) [63.5(41).]

**Plant Diseases.**

- Silver Leaf Disease, IV, *F. T. Brooks* and *H. H. Storey*. (Jour. Pomology and Hort. Sci., III, 3, Sept., 1923, pp. 117-141.) [63.24.]
- Red Plant in Strawberries and its Correlation with "Cauliflower Disease," *E. Ballard* and *G. S. Peren*. (Jour. Pomology and Hort. Sci., III, 3, Sept., 1923, pp. 142-147, figs. 36-42.) [63.24.]
- On the Cause of Rolling in Potato Foliage; and on some Further Insect Carriers of the Leaf-Roll Disease, *P. A. Murphy* (Sci. Proc. Roy. Dublin Soc., XVII, 20, June, 1923, pp. 163-184.) [63.21.]
- Transmission, Variation and Control of Certain Degeneration Diseases of Irish Potatoes, *E. S. Schultz* and *D. Folsom*. (Jour. Agr. Res. XXV, 2, July, 1923, pp. 43-118, plates 1-15.) [63.23.]
- Fusarium Blight of the Cereal Crops, *D. Atanasoff*. (Wageningen Landbouwhoogeschool Med., XXVII (1923), 4, pp. 1-132, plates 1-6.) [63.24.31.]
- Injury to Foliage by Arsenical Spray Mixtures, *D. B. Swingle* and *H. E. Morris*. (Jour. Agr. Res., XXIV, 6, May, 1923, pp. 501-537.) [63-295.]

**Live Stock.**

- The Irish Live Stock Industry, *D. Twomey*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 125-143.) [63.6(415).]
- The Value of Blood Meal as a Pig Food, *E. J. Sheehy*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 169-183.) ([63.60432; 63.64 : 043.]
- White versus Yellow Maize as a Pig and Poultry Food, *T. D. Hall*. (S. Africa Jour. Dept. Agr., Oct., 1923, pp. 352-363.) [63.60432.]

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- The Economics of Milk Recording, *James Wyllie*. (Scottish Jour. Agr., July, 1923, pp. 315-324.) [63.711(b).]
- The Economic Value of Milk to the Producer, *A. G. Ruston* and *J. W. Dallas*. (Milk Industry, Oct., 1923, pp. 111-118.) [63.714; 63.7(42).]
- The Comparative Value of Protein, Fat and Carbohydrate for the Production of Milk Fat, *E. J. Sheehy*. (Sci. Proc. Roy. Dublin Soc., XVII, 24, June, 1923, pp. 211-218.) [63.711(a).]
- The Use of the Self-Feeder with Young Dairy Calves, *A. C. McCandlish*. (Jour. Dairy Sci., VI, 5, Sept., 1923, pp. 500-508.) [63.62(04).]
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- Pasteurization of Milk for Cheddar Cheese-making. The Bacteriological Aspect, *J. K. Murray*. (N.S.W. Agri. Gaz., Aug., 1923, pp. 559-566.) [576-8 : 7.]

**Poultry.**

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## NOTES FOR THE MONTH.

CONSEQUENT on the formation of a new Government, Mr. Noel Buxton, Member of Parliament for North Norfolk, has been appointed Minister of Agriculture and Fisheries. Mr. W. R. Smith, Member of Parliament for Norwich, has been appointed Parliamentary Secretary.

**New Minister of  
Agriculture and  
Fisheries.**

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THE publication of the Final Report of the Departmental Committee on Distribution and Prices of Agricultural Produce brings to an end a task which has occupied the Committee for practically a year. Appointed on the 18th December, 1922, the Committee has held 71 meetings and heard oral evidence from 225 witnesses, representative of producers, distributors and consumers. In addition a vast amount of information was collected direct from distributors by means of questionnaires. Four interim reports have been presented dealing with (1) Milk and Milk Products, (2) Fruit and Vegetables, (3) Meat, Poultry and Eggs, and (4) Cereals, Flour and Bread.

**Final Report  
of the Linlithgow  
Committee.**

The Final Report deals on broad lines with the main problem of marketing and distribution, and is comparatively short, comprising less than 50 pages. In it the Committee has endeavoured to bring together in a summary form some of the principal points which have been brought out in the course of its inquiry, and in particular to supply a reasoned explanation of some of the causes of the difference between the prices received on the one hand by the producer and paid on the

other hand by the consumer. The Report contains an interesting chapter on co-operation as applied to the sale of agricultural produce—the causes of past failures are discussed and some useful suggestions made as to future developments. The Committee also makes recommendations as to the granting of State loans to producers' organisations, the collection and publication of price statistics and other questions. The concluding chapter of the Report deals with the need for further and continuous investigation into methods of marketing agricultural produce, and generally into the economics of agriculture.

The Report can be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 3s. 1½d., post free.

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IN view of the great value of lucerne as a fodder crop, it might profitably be much more extensively grown, particularly in the southern and midland counties and on soils containing a sufficient proportion of lime. An account of lucerne and its cultivation is given in the Ministry's Leaflet No. 160. As a fodder crop for horses, cattle and pigs, it is highly valuable, while it may be converted into hay which is equal to the best clover hay. Some care is needed to get it established, but once growing strongly, it will yield four cuttings a year for from four to eight years.

### **Lucerne in the First Century A.D.**

In this connection it may be of interest to quote the old Roman writer, Columella, who shows us that even in the 1st Century A.D., agriculturists in Italy possessed a sound knowledge of lucerne and esteemed it very highly. He writes thus:—

“Of the more popular fodder crops, lucerne is the best; once sown it will last for 10 years, and can be mown easily four times, often six times, a year. It enriches the soil; any stock in poor condition will get fat on it; it has a salutary effect on ailing animals: a jugerum (say  $\frac{2}{3}$  acre) will keep three horses for a year. The method of sowing is the following:—The land on which the lucerne is to be sown in the following spring should be roughly ploughed about 1st October and allowed to weather all the winter. On 1st February go over it again, removing all the stones and breaking up the clods. Then some time in March give it its third ploughing and harrow it. After



having thus got a good tilth, lay out plots, like garden beds, 10 ft. wide by 50 ft. long, so that water can be led along the intervening paths, and the labourers can have access on both sides to hoe. Then apply well rotted manure, and sow at the end of April at the rate of a cyathus (about 1/12th pint) of seed to a plot 10 ft. by 5 ft. Immediately after sowing, cover the seed with wooden rakes (harrows). This is a very useful proceeding, as the seeds quickly become parched by the sun. After sowing, no iron implement must touch the crop. And, as I have said, it must be harrowed with wooden harrows and frequently weeded, to prevent other plants killing the unestablished lucerne. The first crop should be taken rather late, after it has shed some of its seed. Afterwards it may be cut young, when it has made some growth, and given to stock, but only sparingly at first, until they get accustomed to it, lest the novelty of the fodder should injure them. For it blows stock and causes full-bloodedness. After it has been cut, water frequently. A few days afterwards, when it begins to shoot again, weed out all other plants. So treated it will last 10 years and give six crops a year." (L. Junius Moderatus Columella, Bk. II, Ch. xi.)

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THE growth and extension in the south-eastern counties of schemes for the systematic provision of expert advice on the

### **Rationing of Milch Cows.**

rationing of milch cows are worthy of mention, and some of the factors which have led to this movement may be noticed. It is well known that during, and since, the War a number of new feeding stuffs have come on the market, notably the derivatives of the palm oil industry, formerly almost a monopoly of Germany. In the absence of experience, farmers had little to guide them in the use of these commodities. At the same time the greater attention which is being given to the individual performance of cows as a result of the spread of milk recording, has led to a more general recognition of the need of regulating feeding more in accordance with yield. Experience has also shown that old standards of feeding must be abandoned if the best results are to be obtained from the deep milkers (1,000 gallons and over) which are now to be found in herds. There are authenticated cases in which a heavy-yielding cow has consumed upwards of 20 lb. of concentrated food daily with no traceable evil effects on

her constitution. The day is long past, therefore, when cows could be fed economically on an all-over standard. Individual rationing more in accordance with yield and individuality is necessary, and, moreover, expert advice on the compounding of the ration becomes a necessity. This advice cannot be limited to a single occasion. Prices of concentrated feeding stuffs vary from day to day, and it becomes necessary to compare and compound food stuffs which vary not only in their chemical composition but in their comparative cost per food unit as well. •

Now, while it must be admitted that Agricultural Organisers and others have always been ready and competent to advise in individual cases submitted to them, it has been found that farmers are, generally, much more ready to receive advice than to solicit it. The scheme which experience has shown to be most successful in the Home Counties is one under which, with the approval and support of the local Milk Recording Society, the Milk Recorder on his periodical visits to a farm fills up a printed form containing full details of the quantities of food being fed to the cows and sends a duplicate to the Adviser (normally the County Agricultural Organiser). The latter, thereupon, applying his expert knowledge, returns the form to the farmer concerned with a report on the suitability of the rations, adding, if necessary, suggestions for modification in order to secure economy and increase the milk yield.

Experience has shown, too, that in very many cases under expert guidance, better use can be made of home-produced food, such as roots, hay and straw; and that *over* feeding of *low* yielding cows, and *under* feeding of *deep* milkers, is not uncommon. The savings in cost effected, vary from 1d. to 6d. per gallon,—savings, too, which are immediately apparent in the cash returns from the business of milk production. What must be emphasized, however, is the value of an organised scheme for the provision of advice, founded upon co-operation between a Milk Recording Society and a County Organiser.

In evidence of the extent to which schemes of this description are in operation, and are rapidly extending, in the south-eastern counties, the following brief particulars are appended. They have been supplied by the courtesy of Messrs. McCreath, Garrad, and Jesse, Organisers for the counties of Essex, Kent, and East Sussex, respectively. It is only right to add that the extension of these schemes is largely due to the labours of Mr. J. Mackintosh of the National Institute of Dairying, Reading.



and Mr. G. H. Garrad, Agricultural Organiser for Kent, pioneers of the movement in Berkshire and Kent.

*Kent.*—An organised scheme of advice on rationing has been in operation in Kent for many years. The foundations were laid by Messrs. Mackintosh and Garrad when members of the staff of Wye College under the headship of Mr. M. J. R. Dunstan, now Principal of the Royal Agricultural College, Cirencester. An outstanding and successful feature of the scheme has been the prominence given to comparative cost of production figures. In the year 1922-23, 168 food records were submitted for advice through official Milk Recorders. They related to 100 different herds of which 42 were Shorthorns and 10 Friesian, the rest being either mixed breeds or small herds of Guernseys, Ayrshires and others. An analysis of the returns shows that the cost of food varied from 6d. to 13d. per gallon with a variation of daily yield from 28 lb. to 20 lb. per cow. The most typical results were given by a group of 59 herds in which the cost varied from 8d. to 11d. per gallon.

*East Sussex.*—A rationing scheme was inaugurated in this county in 1919. During last season (1922-23) 413 food records were examined and reported on. Of 218 members of the local Milk Recording Society, no fewer than 187 regularly ration their cows on the basis of advice furnished by Mr. Jesse, the County Organiser. In the Fourth Annual Report of the East Sussex Milk Recording Society, a striking illustration is given of the value of studying the feeding and production of a milking herd.

“During the winter of 1921-22 two herds in the same district were producing milk at a difference in cost (for food alone) of 8d. per gallon. The herds were similar in size but average production per cow per herd varied between 720 gallons per year and 440 gallons.

“The winter production of herd ‘A’ was 7,917 gallons, costing £313 7s. 7d. It would have cost herd ‘B’ £577 5s. 7d. to produce a similar quantity of milk, a difference of £263 18s. These figures illustrate the impossibility of economic production from a low average herd.”

In the case of another large herd, the cost of the ration in January, 1923, was 10½d. per gallon: when modified in accordance with expert advice, the cost was reduced to 8½d. per gallon. This was equivalent to a saving in the cost of food for the whole herd of £1,662 in the six winter months. The Local Authority has published a very useful leaflet containing a large number of sample rations for maintenance and production.

*Essex.*—During last season (1922-23) 255 food records were examined, relating to 47 herds. As a result of the scheme, the average all-over cost per gallon during last winter was only 8½d. per gallon. Another interesting figure is the estimated cost of grazing during the six winter months, viz., £3 15s. 6d. per cow. The progress of the scheme in this county has been promoted by the assistance given by Mr. J. B. Gill, the Secretary of the local branch of the National Farmers' Union.

Similar schemes have recently been adopted in the counties of Surrey, West Sussex, and Hertfordshire. Good progress has been made and there is every reason to expect that the movement will rapidly extend.

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THERE appears to be some misconception in certain parts of the country as to how, and by whom, the *initial steps* in the organisation of an agricultural credit society should be taken. Under Section 2 of the Agricultural Credits Act, 1923, the Government are empowered to make advances to agricultural credit societies, who, in turn are entitled to grant loans to their members for approved agricultural purposes, for periods not exceeding 5 years. An agriculturist can only benefit under this section by becoming a member of an agricultural credit society, and it rests entirely with local agriculturists to initiate the formation of a credit society for their mutual assistance. If there are persons in any agricultural district who desire to obtain loans under this scheme, their first action should be to meet together and examine the possibilities of founding a society in the district, and of obtaining a sufficient number of members to make it a success. In so doing, the promoters would be well advised to communicate with the Agricultural Organisation Society, 40, Broadway, Westminster, S.W.1, who are ready to help in the formation of credit societies. In addition to this, the Ministry has prepared certain memoranda which may be used as guides, setting forth the necessary steps to be taken, to establish a credit society, to effect its registration under the Industrial and Provident Societies Acts, and to obtain from the Ministry the money advances to which such societies are entitled.

To enable a credit society to be registered under the Industrial and Provident Societies Acts, it is necessary for it to adopt rules



setting out its constitution, its method of operation, and the manner in which it must be conducted, in order to conform with the provisions of these Acts and the Agricultural Credits Act, 1923. For the purposes of assisting societies in preparing their rules, model rules which have been approved by the Ministry and the Chief Registrar of Friendly Societies, have been prepared, and may be obtained from H.M. Stationery Office, Imperial House, Kingsway, W.C.2.

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THE Ministry hopes to announce at an early date the conditions under which scholarships for the sons and daughters of agricultural workers will be awarded for the next academic year. The value of these scholarships is such that no outlay on the part of parents or scholar is necessary during the tenure of the scholarships. The scheme, which was instituted two years ago, has achieved a considerable measure of success, and it is most desirable that the facilities afforded by it should be widely known. At present, 13 students are taking degree courses in agriculture or an allied subject at Universities; 20 are taking diploma courses at Agricultural Colleges; and about 70 are attending Farm Institutes, etc., for short courses in agriculture, horticulture, dairying, or poultry-keeping.

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EVERY effort is being made to ensure that the Agricultural Research Exhibits at the British Empire Exhibition will be intelligible and interesting to both the agricultural and the urban public. It is realised that it is not sufficient to get together a representative, judiciously selected, well displayed and labelled exhibit. The experience of museums and picture galleries has conclusively proved that a collection of this kind may be, as far as the general public is concerned, a mere mausoleum. Those who are scientifically trained can pick their way through such a collection and discover the material of which they are in search, but only because they are trained to know what to look for. Until a few years ago, it was for this class and for this class alone that museums catered: now, however, museums have begun to make an appeal to the widest possible circle, and they have found that the one sovereign method of throwing open their collection to the public, is to engage the services of com-

**Agricultural  
Research  
Exhibits at the  
British Empire  
Exhibition.**

petent guide lecturers who will, at intervals during the day, explain the significance of selected specimens in the galleries.

The forthcoming agricultural exhibit at the British Empire Exhibition will therefore be explained and demonstrated to the public on the lines adopted by the most popular museums. With the assistance of the Research Institutes and Agricultural Colleges of Great Britain—who are contributing the bulk of the collection—an exhibit has been brought together which will not only illustrate all the aspects of modern research, but which explains the scientific side of modern farming, the forces which make for success, and the forces which have to be kept in check.

Fuller details of the exhibit will appear in later issues of the *Journal*. Here it must suffice to say that eight principal divisions have been made:—Animal breeding and nutrition (including dairying); veterinary science; soils; plant breeding; plant pathology; horticulture; agricultural machinery; and agricultural economics. The divisions will be so arranged in the hall as to tell a continuous story—of the soil and its manuring and working, of crops and animals in health and disease, and the methods of combating disease. Qualified guide-lecturers will attend to explain at stated times the significance of the specimens and pictures, to supplement printed programmes and guides, and to put into words the story which to the initiated the cases will tell.

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THE decline in the prices of agricultural produce, which was very sharp in 1921 and 1922, was much less marked in the

**The Annual  
Index Number of  
Agricultural  
Prices.**

past year, the average of the prices of all commodities sold off farms in 1923, after making due allowance for the relative importance of the different articles, being 57 per cent. above the average of 1911-13.

The decline as compared with 1922 was therefore only 12 points, as compared with reductions of 50 and 73 points respectively in the previous two years:—

Year.		Percentage Increase in the Prices of Agricultural Produce as compared with the three years 1911-1913.	
1915	...	...	27
1916	...	...	60
1917	...	...	101
1918	...	...	132
1919	...	...	158
1920	...	...	192
1921	...	...	119
1922	...	...	69
1923	...	...	57



Prices generally have been at about the same level in 1923 as in 1916, but grain, hay and potatoes were much below the 1916 level, and milk, dairy produce, eggs, fat sheep, fruit and hops considerably above. The decline as compared with 1922 was not due to any great extent to falling prices during 1923—in fact the monthly index numbers of prices during the greater part of 1923 showed comparatively little variation—but mainly to the higher prices in the first eight months of 1922, after which a sharp fall took place. During the last four months of 1922 the average increase over pre-war was very little different from that of the corresponding period of 1923.

Most commodities were cheaper than in 1922, and potatoes were relatively the cheapest, being only 13 per cent. above pre-war. During the first six months of the year, when the very heavy crop of 1922 was being marketed, wholesale potato prices in the large towns were lower than in 1911-13, being about 30 per cent. below from April to June. The new crop, which was small, has sold at much higher figures, realising from 60 to 90 per cent. above pre-war.

On the average cereals were appreciably lower in price than in 1922, but wheat was 1d. per cwt. and barley 10d. per cwt. dearer, with oats 5d. per cwt. cheaper, in December than a year earlier. Apart from potatoes, cereals on the whole showed a relatively smaller increase over 1911-13 than any other commodity, averaging only 26 per cent. above. Hay was also comparatively cheap, being only 30 per cent. above pre-war, but since the new crop, which was heavy, came on the market prices have declined, and during November and December were no higher than before the War.

Over the whole year milk averaged 74 per cent. above 1911-13, or only 5 points less than in 1922, and was one of the dearest commodities. Butter showed little change from the previous year at 59 per cent. above pre-war, but cheese which was relatively cheaper than butter in 1922 advanced to 69 per cent. above pre-war. The percentage increases as compared with 1911-13 in milk, butter and cheese respectively were more uniform in 1923 than in any year since the end of the War. Eggs declined from 93 per cent. above 1911-13 in 1922 to 68 per cent. above in 1923, but at the end of the year were dearer than in December, 1922. Poultry also showed a fairly similar decline.

Fat cattle, sheep and pigs all realised reduced prices, but sheep remained at a higher level than other fat stock. Fat cattle prices were comparatively steady during the year and at the close were practically the same as at the end of 1922, but in the case of sheep the usual autumn rise did not bring prices up to the level of December, 1922. Fat pigs have become much cheaper during the past year. At the end of 1922 they were practically double the pre-war price, whereas in December, 1923, they were only about 40 per cent. above.

Fruit crops in 1923 were poor and prices were consequently high, averaging more than double 1911-13. Vegetable prices generally followed much the same course as potatoes, being low in the first half of the year and comparatively high in the second half, and over the whole year averaged 48 per cent. above pre-war against 96 per cent. above in 1922. Hops yielded lighter crops than in the previous year, and the average price was fixed by the Hop Control at £13 per cwt. against £10 10s. per cwt. for the 1922 crop.

Wool showed a further rise in price in 1923, and at the summer wool sales averaged 44 per cent. above pre-war, as compared with only 14 per cent. above in 1922.

*Percentage Increase in the Prices of Agricultural Produce during the years 1916 to 1923, as compared with the average of the three years 1911-13.*

Commodity.	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.
Wheat ...	79	132	123	123	147	119	46	30
Barley ...	88	128	108	167	215	84	41	19
Oats ...	68	151	149	164	187	72	47	35
Fat Cattle ...	58	105	111	132	163	127	63	51
Fat Sheep ...	57	97	110	136	187	117	100	87
Fat Pigs ...	67	126	166	176	230	128	87	65
Hay ...	52	57	87	157	192	51	40	30
Potatoes ...	88	137	79	135	206	132	79	13
Milk ...	57	91	151	200	203	163	79	74
Butter ...	36	77	109	115	199	115	61	59
Cheese ...	49	103	133	169	140	71	43	69
Poultry ...	36	69	159	127	141	112	92	73
Eggs ...	59	111	258	255	239	142	93	68
Fruit ...	38	54	311	218	279	183	88	117
Hops ...	19*	9*	93	113	105	111	23	52
Wool...	46	62	74	208	253	16*	14	44
Beans and Peas ...	70	170	377	219	188	96	80	86
Vegetables ...	54	138	157	157	119	146	96	48

\* Decrease.

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THERE has been a steady decrease in the number of premises found to be affected with foot-and-mouth disease in recent weeks. In the week ending 29th December, the number was 320; in that ending 5th January, 256; in that ending 12th January, 193; and in the week ending 19th January, 115. A similar decrease is to be noted in the figures for Cheshire,

#### Foot-and-Mouth Disease.



where the disease is far more prevalent than in any other county in Great Britain. This will be seen from the following figures from Cheshire:—Week ending 29th December, 212; week ending 5th January, 160; week ending 12th January, 110; and in the week ending 19th January, 63. The improvement in the position is also shown in the fewer cases of suspicion of disease reported to the Ministry, and in the very few new centres of disease which are being discovered. It is too early still to prophesy that the outbreak will speedily be terminated, but the situation gives distinct hope that it will at any rate be possible, if the present policy can be pursued during the whole course of the outbreak, to prevent any further large conflagration such as that which has occurred in Cheshire.

Up to and including the 21st January, the total number of outbreaks since the present epidemic started on the 27th August last is 2,403. The numbers of animals slaughtered, or authorised to be slaughtered, are—Cattle, 82,147; sheep, 28,056; pigs, 38,143. These figures represent a percentage of 1.1 in the case of cattle, 0.14 per cent. in the case of sheep, and 1.4 per cent. in the case of pigs, of the total number of animals in each category in Great Britain. The estimated gross compensation payable for slaughtered animals up to that date was £2,524,000, of which about £325,000 is expected to be returned from the salvage of healthy carcasses.

An addition to the exception to the general policy of slaughter made in the case of pedigree herds has been adopted. It concerns the dairy stock in certain badly stricken areas of Cheshire which are on farms where the buildings and surroundings are such as, in the Ministry's view, make it possible to isolate without danger to other stock, or to the ultimate success of the stamping-out policy. The Ministry is prepared in these cases to adopt isolation in the same way as it has been adopted in suitable cases where pedigree stock are concerned. It will be understood that the Ministry must be the judge of what cases are suitable for isolation in the districts of Cheshire in which this concession will be operative, and that where the Ministry prescribes isolation there will be no compensation paid for losses which may be sustained. This alteration does not constitute any departure from the stamping-out policy, or a reversion to a policy of isolation. The Ministry is more than ever convinced that the principle of slaughter is the only policy which can safely be adopted in the generality of cases where foot-and-mouth disease is discovered.

## TURNIPS, SWEDES AND KOHL RABI FOR STOCK FEEDING.

J. R. BOND, M.Sc.,

*Agricultural Organiser for Derbyshire.*

**History.**—Turnips were apparently grown as a garden vegetable in this country long before they became a field crop. During the 16th and 17th centuries their adoption for field cultivation was advocated by writers, especially Sir Richard Weston, who had seen turnips grown extensively in Holland and Germany. At that time, however, most of the arable land in Britain was worked on the open field system, wherein each occupier held scattered strips unfenced from his neighbours' land and open to the live stock of the parish after corn harvest. With the extension of enclosures, turnip cultivation gradually spread during the 18th century, effecting in its progress a transformation in farming methods and imparting those characteristics which came to be regarded as the distinctive features of modern British agriculture. Swedish turnips were introduced in 1777; but it was not until about 1850 that this kind had largely displaced the softer sorts of turnip in such an important arable county as Lincolnshire. The Kohl rabi, formerly called the Hungarian turnip, was introduced into Britain about 1830.

Turnip husbandry as we now know it, including the practices of drilling, ridging, singling and horse hoeing, is little more than a century old in many parts of Britain. It reached its zenith about 50 years ago; since when, with the general decline in arable cultivation, the turnip acreage has steadily diminished. In Denmark, however, where turnip cultivation was learnt from Britain, the acreage under this crop has steadily increased during the same period.

**Influence of the Turnip.**—Lord Ernle in the preface to his *English Farming Past and Present*, says that the introduction of the field cultivation of turnips was as truly the parent of a social revolution as was the introduction of textile machinery. Previously arable land had been bare fallowed after every two corn crops. When turnips and clover were introduced in the rotation, food became available for the winter feeding of greater numbers of cattle and sheep; and fresh meat began to replace salt flesh in the human winter diet. The improvement in the quality of British live stock was also intimately connected with the extension of turnip cultivation.

The maintenance of greater numbers of sheep and cattle



improved the condition of the soil, with the result that the yield of corn was more than doubled. The substitution of bare fallowing by manuring, as the means of fertilising the soil, brought into cultivation light land, which, although unproductive under the corn and fallow rotation, was found to be very suitable for turnip husbandry. Large areas of light land in Norfolk, Lincolnshire and Northumberland, which had previously been waste, were so reclaimed during the last quarter of the 18th century. Lastly may be mentioned the fact that the need for better implements with which to clean and prepare the tilth for turnip sowing brought about an improvement in the farmer's tillage equipment.

**Turnips and Sheep.**—There are districts where arable farming is pursued with sheep as the main object and here turnips are specially required to provide winter food for the flock. The principal source of income in typical British arable farming is, however, corn crops. Where the soil is light and the rainfall low, it is considered necessary to fold sheep on the land to bring it into the firm and enriched condition requisite for the production of good yields of grain. The turnip crop provides part of the food necessary for winter folding, while its cultivation affords an opportunity for cleaning the land, without the loss of organic matter associated with bare fallowing: light dry land is very dependent on the liberal addition of organic matter.

It is under such conditions as the above that turnip husbandry is most extensively practised—in the sheep and corn districts of Norfolk, Lincolnshire, Notts, Yorkshire, Durham, Northumberland, Suffolk, Hampshire and Dorset. The climatic conditions in these counties are not so favourable to the growth of turnips as in the moist western counties, where much heavier yields per acre are obtained; the greatest areas of turnips are grown, however, where there is the largest acreage of corn, where the roots are required for sheep feeding, and where the crop may be folded on the field in winter without harm but with benefit to the land.

Turnips alone are not an ideal or even a good ration for sheep. Sheep are adapted for dry conditions and for a ration in which the proportion of dry matter to water is about 1:3. In roots there is one part of dry substance to about nine parts of water; hence sheep on turnips should have a liberal allowance of dry fodder. Experiments indicate that the best quantity of roots to feed per week is about the weight of the sheep. The consumption of excessive quantities of roots is best checked by the

provision of sufficient dry fodder, especially clover hay: almost as much dry matter in the form of hay and concentrates should be fed as the sheep receives in its ration of roots. When transferring sheep from grass (which has a dry matter to water ratio of about 1 : 3½) to soft turnips (1 : 10) the provision of dry fodder is specially necessary.

Typically, a weekly ration of 100 lb. of swedes is accompanied by an allowance of 5 lb. of hay and 5 lb. of cake and corn. Although the nutriment in roots and hay is mainly carbohydrate matter, the supplementary concentrated food given to sheep being fattened on turnips need not be high in protein; in fact the feeding of too liberal an allowance of protein is dangerous to sheep.

In some districts it is not customary to pit or even to lift and cut roots for sheep; and, as regards the softer kinds of turnip fed before Christmas, pitting and cutting are not of great advantage. With swedes, however, which begin to be folded about the time when hogs are undergoing dental changes, fingerling is desirable. Further, when the roots are lifted and cut, the crop is consumed with less loss and waste, and the practice avoids the troubles caused by the excessive consumption of grit associated with the gnawing of dirty shells. In recent years, there has not been sufficient frost to cause much trouble through the feeding of frozen turnips; but it is considered good practice always to have sufficient roots lifted and stored to carry the flock through any ordinary period during which the roots and ground might be frost bound.

**Turnips and Cattle Feeding.**—The production of corn under a permanent system of agriculture necessitates converting the straw into manure to maintain the condition of the soil, especially its humus content. The ordinary method of effecting this conversion is to fatten cattle indoors in winter on roots and concentrates together with as much straw as they can eat and tread down. Typically about half the turnip crop grown on the farm is thus carted to the steading and utilised for cattle feeding, the other half being fed to sheep on the land. Where, as on the heavier soils, the proportion of straw crops to roots is commonly 3 to 1, a greater proportion, even to the whole of the root crop, is fed in the cattle yards.

The quantity of turnips in the daily ration of fattening cattle varies, according to the supply of roots available, between 40 and 120 lb. per head. As to what is the best allowance for fattening purposes, experiments suggest that about 3 cwt. per head per day may be recommended for the ordinary 2½ years



old cattle used in winter feeding practice. This ration is also a convenient one for the typical feeding farm; the root crop yielding 15 tons per acre and the straw  $1\frac{1}{4}$  tons, and with 3 acres of straw per acre of roots, the daily allowance of straw for food and litter may be 22 lb. and that of the roots 88 lb. per head. Where the proportion of roots to straw crops is 1 : 2 and half of the roots are fed on with sheep, the above-stated allowance of 22 lb. of straw per day would be accompanied by a ration of 66 lb. of roots.

As regards the method of feeding roots to the older fattening cattle, Scotch practice is largely in favour of giving the roots whole and the straw unchaffed. In England, however, many feeders pulp the roots and mix with the pulp a considerable quantity of straw chaff and part or the whole of the concentrates. Although the latter practice is often recommended, there is reason to believe that the foods are better masticated and ruminated if fed with less preparation. In an experiment at Garforth in 1903-4, bullocks fed with sliced swedes and yellow turnips gained 2.07 lb. per head per day as compared with a gain of 1.64 by a similar lot which received the same quantities of roots, straw and concentrates—but with the roots pulped and mixed with the chaff and meals. Similar results have been observed in practice with dairy cows.

The “corn and horn” farmer grows roots for the main reason that his land requires a thorough working and cleaning once every four or five years; the root crop, especially turnips, allows of this while producing a return in food material to cover part or the whole of the cost of its cultivation. The returns from winter fattening of cattle are, however, commonly so small that farmers do not as a rule devote land primarily to the production of fattening material. The root crop is, therefore, restricted to the area entitled to be cleaned in the proper course of rotation rather than extended at the expense of other crops.

Under conditions that are not favourable to the safe and cheap production of good turnip crops, arable farmers are constantly seeking ways of avoiding the necessity for growing roots. Four such methods have been tried: 1. Farming without cattle, the straw being sold off and the loss in manurial constituents being compensated by the return to the farm of artificials and town manure. 2. Converting the straw into artificial yard manure. 3. Cattle feeding without roots, their place being taken by additional concentrates, of which treacle is one. 4. Substituting the root crop with a crop of tares for hay or ensilage and cleaning the land by bastard fallowing after harvesting the tares.

**Turnips and Cattle Rearing.**—McCombie, of Tillyfour, wrote: "I make it an almost universal rule (and I have never departed from the rule except with a loss), that I will graze no cattle except those that have been kept in the open straw-yard, and have been fed exclusively on turnips and straw. If you can get them off yellow turnips it will be decidedly to your advantage." As regards the comparative merits of chemically equivalent weights of swedes and yellow turnips, experiments at and in connection with Cockle Park in 1911-13 showed that two-year old shorthorns made smaller gains in winter but much more rapid progress in summer after wintering on a ration that included yellow turnips instead of swedes. Yearling blue-greys, however, gave the opposite results.

Experiments were carried out at Cockle Park to compare the immediate and after-effects of three methods of wintering and feeding yearling blue-grey cattle. Each lot received in winter a basal ration of 6 lb. hay and  $1\frac{3}{4}$  lb. soya cake, but in addition Lot 1, wintering out, had (in 1911-12) 2 lb. maize meal and  $2\frac{1}{4}$  lb. straw, or (1912-13) 1 lb. cotton cake and 3 lb. hay; Lots 2 and 3 received 25 lb. swedes or  $33\frac{1}{2}$  lb. yellow turnips respectively, and were housed at night. The weekly gains in lb. per head were as follows:—

<i>Year.</i>	<i>Feeding.</i>			<i>Winter.</i>	<i>Spring.</i>	<i>Summer.</i>	<i>Average.</i>
1911-12.							
	Lot 1. (root substitute) ...	...	...	10·0	2·2	13·4	10·3
	„ 2. Swedes ...	...	...	8·0	4·0	15·6	10·5
	„ 3. Yellow Turnips ...	...	...	8·4	2·4	14·9	10·2
1912-13.							
	Lot 1. (root substitute) ...	...	...	1·86	1·86	15·25	6·73
	„ 2. Swedes ...	...	...	6·30	5·87	15·0	9·22
	„ 3. Yellow Turnips ...	...	...	6·62	3·33	13·75	8·42

**Turnips and Dairy Farming.**—The most thorough investigation of the importance of roots in the production of milk has been made in Denmark. Commencing in 1884 with pigs, and in 1887 extending his feeding trials to dairy cows, Fjord obtained results that completely changed the Danish farmers' attitude towards root crops. The acreage under turnips, swedes and mangolds in Denmark was 95,000 in 1888, but by 1919 it had increased to 678,000; and Fjord's advice to grow a statute acre of roots for every three adult animals in the herd has been adopted as standard practice.

Fjord's feeding trials showed "that roots had a very considerable value; that roots could replace corn and oil cake in the food of both cows and pigs without changing their growth or the production of milk: that the addition of roots to the food



increased the milk yield of cows and made them lay on flesh at the same time; and that the larger yield of milk produced by giving roots was not caused by a greater proportion of water in the milk, but that the larger yield was of milk of the same richness as the milk produced without roots . . . . that 1 lb. of dry matter in roots has the same feeding value as 1 lb. of corn . . . . and that the dry matter in mangolds and swedes had the same feeding value, pound for pound, when fed to milch cows" (Faber: *Forage Crops in Denmark*).

In three experiments with cows at Bangour, Edinburgh, Lauder and Fagan compared the effect on the yield and composition of milk caused by substituting 72 lb. of turnips for 6 lb. of protein-rich meals, in a normal ration of 40 lb. of turnips, 15 lb. of hay and 10 lb. of concentrates. Each lot of cows had 15 lb. of hay, but whereas Lot 2 had 10 lb. of concentrates and 40 lb. of roots, Lot 1 had only 4 lb. of meals with 112 lb. of roots. The meals fed varied and the heavy turnip ration each year contained about  $\frac{1}{2}$  lb. less of digestible protein than the normal ration fed to Lot 2. For this reason it might have been expected that the turnip ration would produce rather less milk, as in fact it did; but, contrary to common expectation, the more watery turnip ration in each experiment produced the milk with the higher fat content. The experimenters suggest that "the easily digestible carbohydrates contained in the turnips are specially suitable for fat formation." The actual yields and fat percentages were as follows:—

Experiment.	Lot 1. Turnip ration.		Lot 2. Ordinary ration.	
	Total yield	Average	Total yield	Average
	of milk. lb.	percentage of fat.	of milk. lb.	percentage of fat.
I. (1909)				
10 cows per lot; 9 weeks	15,240	3.49	15,818	3.09
II. (1910-11)				
11 cows per lot; 8 weeks	13,920	3.55	14,069	3.35
III. (1911-12)				
9 cows per lot; 10 weeks	14,345	3.68	15,637	3.26

**Turnip Plant.**—One of the objections often urged against the feeding of turnips to dairy cows is that they taint the milk. Dunne, writing of Danish practice (this *Journal*, April, 1916, p. 58), remarks that "the risk of imparting a bad flavour to the butter, popularly called 'turnip flavour,' disappeared as soon as the pasteurisation of milk became general. Since the advent of pasteurisation, the use of swede turnips

as a food for dairy cows has been steadily extended in Denmark. . . . Every Danish dairyman is convinced that roots are an indispensable constituent of an economic ration for cows. . . . When roots can be added to the ration in liberal quantities the cost of the ration is reduced to the minimum, and a maximum profit is obtained." It is significant that in recent years little has been heard of the matter of "turnip flavour." This may be due to the wide extension of the pasteurisation process in the British whole-milk trade. Replies from some of the largest firms engaged in the milk trade, however, contain the opinion that pasteurisation does not completely eliminate the said flavour. The Dairy Manager of the Derby Co-operative Society, which retails about 4,000 gallons of milk per day, is of opinion that the aeration of the milk during its proper passage over the cooler is a means of eliminating "turnip taint." A Derbyshire farmer's wife, who has won many and important prizes with her butter, informed the writer that she had never had trouble with "turnip taint" since she introduced the cream separator, although she often had such difficulties in the old days of hand skimming.

**Roots or Hay?**—In some districts there is a tendency to rely too much on hay as the basis of the winter rations of dairy cows. A critical study of such rations and their results in comparison with those which include a good allowance of roots, shows that there are limits to the usefulness of hay in milk production. The feeding of large quantities of fibrous fodder taxes the digestive capacity and energy of the cow and reduces her yield. On fair pasture, a cow can extract the 15 lb. of starch equivalent required in the production of 3 gallons of milk by the consumption of 27 lb. of dry matter in pasture grass. But to extract the same quantity of nutriment from hay, she would have to consume 42 lb. of dry matter, the digestion and utilisation of which would obviously divert the energy of the beast from her main function of milk production. In a good dairy ration the starch equivalent per 100 lb. of dry matter is about the same as that in pasture grass, to obtain which proportions it is necessary to limit the allowance of dry fibrous fodder to 15 or 17 lb. and supply the rest of the nutriment in the form of concentrates or roots.

A good root crop produces about three times as much effective milk-producing matter as a good crop of hay, as the



following comparison (omitting tops and aftermath) indicates :—

			Digestible Protein. lb.	Starch Equivalent. lb.	Milk-producing capacity. gallons.
Swedes, 20 tons	...	...	493	3,270	545
Meadow hay, 30 cwt.	...	...	181	1,035	173

**Composition of Turnips.**—The amount of dry substance per 100 lb. of roots, or the percentage of dry matter is; in kohlrabi about 12.5, in swedes about 11.5, in yellow turnips about 9.5, and in soft white turnips about 8.0. In each kind, however, a difference of 1 per cent. either above or below these figures may occur, the chief causes of variation being seasonal influences, variety, and size of roots. Turnips grown in Scotland do not show higher percentages of dry matter than English-grown roots.

The dry substance of turnips is somewhat similar in nutritive value to that in oats and other carbohydrate concentrates. The higher lime-content of swedes in particular, however, is noteworthy in view of the recent fuller recognition of the importance of sufficient lime in the diet of dairy cows. At Wisconsin it was found that cows fed on lime-poor rations generally aborted or brought weakly calves and that these troubles could be averted by correcting the deficiency. Lime salts are also believed to have a specific favourable action on the reproductive organs; but, whether this or the vitamin content of turnips is the cause, it appears to be the case that cows breed more regularly where the winter ration includes a proper allowance of roots instead of too much wet grains and concentrates.

The following table, compiled from figures published by Dr. Crowther and Professor Wood, will facilitate the comparison of turnips with other farm food stuffs:—

Food Stuff.	Per 100 lb. of the natural food stuff.		Per 100 lb. of the dry substance.		
	Moisture.	Dry Matter.	Digestible Protein.	Starch Equivalent.	Lime.
	lb.	lb.	lb.	lb.	lb.
Oats ...	13.3	86.7	9.2	68.6	0.1
Swedes ...	88.5	11.5	9.6	63.5	0.9
Soft turnips ...	91.5	8.5	7.1	51.7	0.5
Kohl rabi ...	87.3	12.7	5.6	65.3	1.5
Mangolds ...	88.0	12.0	5.8	51.7	0.4
Pasture grass ...	80.0	20.0	12.5	56.0	2.0
Meadow hay ...	14.3	85.7	6.3	35.9	1.2

## SUB-SOILING TRIALS IN ESSEX.

WITH the co-operation of the East Anglian Institute of Agriculture, Chelmsford, the Ministry laid down last winter and spring a series of sub-soiled plots upon which it is proposed to take observations for five years. A further series is about to be laid down in the Oxford district. As a result, it is hoped that a good deal will be learned of the effect of sub-soiling, about which very little is really known at present.

A general description of methods was given in this *Journal* in January, 1923,\* which will serve as an introduction to the present note on the Essex trials. This note relates to one season's work only, and will not discuss the details either of the operation or the results to the soil and the crop: such a discussion must wait until much more work has been done and many more observations taken. But the practical results of the Essex trials, measured by the crops, have been so markedly and uniformly successful as to warrant the publication of the figures of crop yields, in order that farmers who have not already done so, may consider whether it is not worth while to experiment on a field or two.

A few words may be said as to the scale of the trial. There were eight fields used in all, with a total area of 66 acres. The trial plots in the winter of 1922 had an average area of 0.852 acre, and those for the spring of 1923, 0.777 acre. These fields were chosen because they offered representative soil conditions from comparatively light land to heavy clay, viz.:—Sand and Gravel, Brick Earth, Boulder Clay and London Clay. Potatoes were grown on two fields of Sand and Gravel, and one field of Boulder Clay. Wheat was grown on London Clay and barley on Brick Earth.

It should be explained that the fields were divided into strips, that the control plots (which were ploughed and not sub-soiled) were situated between the sub-soiled plots, and that subsequent to ploughing and sub-soiling, each plot on the same field received identical treatment. It sometimes proved impossible to harvest the whole of each trial plot separately, and in such cases, sample plots were taken at regular intervals, and from the yield so obtained the total yield of the whole plot was calculated.

It will be seen that there are two types of tables for each crop. The first is for the un-sub-soiled plot which has a final

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\* Preliminary Report of a Trial of Sub-soiling Devices at Tonbridge. Jan., 1923, p. 911.



column giving the average value of the crop. The second is for the sub-soiled plot which has a final column giving the value of the increased or decreased yield due to the sub-soiling; an example of this is shown in table 1 for Kerr's Pink Potatoes. The average value of the potatoes per acre for the control plot is £25 19s. 2d., whilst the average value of the increased yield for the sub-soiled plot amounts to £7 4s. 9d. per acre.

**Table I.—Kerr's Pink Potatoes.**—Fields A and B were situated approximately 12 miles apart, and were sub-soiled in the winter of 1922 and spring of 1923 respectively. It will be seen that in field A sub-soiling at a depth of 7 in. produced the best results, but in field B sub-soiling at 5 in. was most remunerative. For Boulder Clay 9-in. sub-soiling proved best. There was a smaller proportion of chats to ware on all the sub-soiled as against the control plots, and in all cases, sub-soiling produced an increased yield. The effect therefore of sub-soiling was clearly to accelerate maturity—a point which will be kept under observation.

**Table II.—King Edward Potatoes.**—King Edward potatoes were grown on a portion of the sand and gravel fields A and B referred to in the previous table. The results agree with those obtained for Kerr's Pink potatoes, and show that for field A 7-in. sub-soiling, and field B 5-in. sub-soiling, produced the best results. An extremely small proportion of chats to ware was obtained on both fields.

**Table III.—King George Potatoes on Boulder Clay.**—The yield of potatoes is small by comparison with other fields, but this is probably due to the extremely dry condition of the soil when the potatoes were planted. The sub-soiled plots, however, show an increase in every case over the control plots. It will be seen that no great difference in the additional yield was shown between the sections sub-soiled at different depths.

**Table IV.—Barley on Brick Earth.**—The barley referred to in this table was sown very late, and only 16 weeks elapsed before harvesting. In this case sub-soiling at 9 in. produced the greatest additional yield.

**Table V.—Wheat on London Clay.**—The whole of the field of London Clay to which the figures relate was mole drained, and a portion sub-soiled by steam tackle. The crops from the sub-soiled and un-sub-soiled parts of the field were harvested and thrashed separately.

COSTS, YIELDS AND VALUES, ALL PER ACRE.

TABLE 1.  
POTATOES. KERR'S PINK.

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.		Value.		
			Ware.	Chats.			
Sand and Gravel (A)	5	s. 10 d. 4	Tons. 4.18	Tons. .725	£ 24	s. 8	d. 9
Sand and Gravel (B)	5	10 4	7.15	1.6	42	10	6
Boulder Clay	5	14 2	1.81	.48	10	18	3
Average ...	5	11 7	4.38	.935	25	19	2



(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.			Gain or Loss (—) in Yields.			Gain or Loss.			Value.		
								Weight.					
					Ware.	Chats.		Ware.	Chats.				
	Inches.	s.	d.	Tons.	Tons.	per cent.	per cent.	£	s.	d.			
Sand and Gravel (A) ...	5	6	3	2.69	.141	64.33	19.44	15	1	6			
Sand and Gravel (B) ...	5	5	9	2.23	.05	31.19	3.12	12	7	3			
Boulder Clay ...	5	4	9	1.07	— .063	59.11	— 13.12	5	15	2			
Average ...	5	5	7	1.999	.043	51.54	3.14	11	1	2			
Sand and Gravel (A) ...	7	5	5	1.49	— .005	35.64	— .69	8	3	9			
Sand and Gravel (B) ..	7	7	2	3.73	— .25	52.16	— 15.62	20	0	3			
Boulder Clay ...	7	5	1	.98	— .104	54.14	— 21.66	5	3	7			
Average ...	7	5	11	2.07	— .12	47.21	— 17.66	11	2	6			
Sand and Gravel (A) ..	9	10	2	.265	— .265	6.34	— 35.17	0	19	6			
Sand and Gravel (B) ...	9	7	4	2.9	— .14	40.56	— 6.2	15	15	0			
Boulder Clay ...	9	6	3	.91	— .007	50.27	— 1.45	4	19	10			
Average ...	9	7	11	1.36	— .134	32.39	— 14.27	7	4	9			

**TABLE 2.**  
**POTATOES. KING EDWARD.**

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.		Value.
			Ware.	Chats.	
Sand and Gravel (A)	...	s. d. 10 4	Tons. 5.59	Tons. 1.02	£ s. d. 38 7 6
Sand and Gravel (B)	...	10 4	6.75	1.28	46 8 8

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.		Gain.		
			Ware.	Chats.	Weight.		
					Ware.	Chats.	
			Tons.	Fons.	per cent.	per cent.	£ s. d.
Sand and Gravel (A)	...	s. d.	3.14	.05	56.1	4.9	20 10 2
Sand and Gravel (B)	...	5 9	1.03	.36	15.2	28.1	7 8 4
Average	...	6 0	2.085	+ .205	35.65	16.5	13 19 3
Sand and Gravel (A)	...	5 5	2.03	.185	36.3	— 18.1	12 16 6
Sand and Gravel (B)	...	7 2	4.33	.06	64.1	4.6	28 5 4
Average	...	6 3	3.18	.062	50.2	6.75	20 10 11
Sand and Gravel (A)	...	10 2	.525	.14	9.3	— 13.7	3 2 8
Sand and Gravel (B)	...	7 4	1.68	.01	24.8	.78	10 18 0
Average	...	8 9	1.102	.065	17.05	— 7.24	7 0 4

Value.



**TABLE 3.**  
**POTATOES. KING GEORGE.**

*(a) Control Plots.*

<i>Soil.</i>	<i>Depth of Ploughing.</i>	<i>Cost of Ploughing.</i>	<i>Yield.</i>		<i>Value.</i>
			<i>Ware.</i>	<i>Chats.</i>	
Boulder Clay ... ..	Inches. 5	s. d. 14 2	Tons. 2·34	Tons. ·36	£. s. d. 13 11 9

*(b) Sub-soiled Plots.*

<i>Soil.</i>	<i>Depth of Sub-soiling.</i>	<i>Extra Cost of Sub-soiling.</i>	<i>Difference in Yield.</i>		<i>Gain.</i>	
			<i>Ware.</i>	<i>Chats.</i>	<i>Weight.</i>	
					<i>Ware.</i>	<i>Chats.</i>
Boulder Clay ... ..	Inches. 5	s. d. 4 9	Tons. 1·36	Tons. ·07	per cent. 58·12	per cent. 19·44
Boulder Clay ... ..	7	5 1	1·29	·143	55·12	39·72
Boulder Clay ... ..	9	6 3	1·30	·12	55·55	33·33
						£ s. d. 7 12 5
						7 7 8
						7 7 10

**TABLE 4.**  
**B A R L E Y.**

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.	Value.
Brick Earth ... ..	Inches. 5	s. d. 8 1	lb. 1,174	£ s. d. 4 14 4

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.	Weight.	Gain.	Value.
Brick Earth ... ..	Inches. 5	s. d. 3 3	lb. 220	per cent. 18.7		£ s. d. 0 17 8
Brick Earth ... ..	7	3 0	244	20.8		0 19 8
Brick Earth ... ..	9	6 3	343	29.6		1 8 0

**TABLE 5.**  
**W H E A T.**

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.	Value.
London Clay ... ..	Inches. 5	£ s. d. 1 11 1	Bushels. 44.36	£ s. d. 12 5 5

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.	Weight.	Gain.	Value.
London Clay ... ..	Inches. 7	s. d. 13 11	Bushels. 11.64	per cent. 26.2		£ s. d. 3 4 5



**General Results.**—The tables show that *in the first year every sub-soiled plot produced an increased yield, the value of which was greater than the extra cost of sub-soiling over ploughing.* A recent examination of the various plots suggested that the effects of sub-soiling will last for some further considerable time.

The figures indicate that the best depth of sub-soiling may vary from field to field even in the case of soil apparently similar in character. This is a point which is receiving investigation, but the results certainly suggest that any farmer who proposes to practise sub-soiling, would be well advised to experiment at different depths for the first year and determine by the results obtained the most profitable depth for his own particular conditions.

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## CO-OPERATIVE MARKETING OF MILK IN THE UNITED STATES.

THE distribution of milk has always been one of the most difficult problems of organisation which agriculturists have to face. It is one towards the more satisfactory solution of which great efforts have been made in the United States during recent years.

The difference between producers' and consumers' prices, and the high cost of distribution, are points which are well known to characterize the milk trade in this country. A very full analysis of the causes leading to this state of affairs is given in the Interim Report on Milk and Milk Products of the Linlithgow Committee.\* In the United States no less than in this country have the characteristics referred to been the general rule. The milk middlemen in America absorb a very large proportion of the consumers' price. It has been said that on the average of the available data for 1920-1922, the distributor gets more than 60 per cent., the producer less than 32 per cent., while transport costs absorb about 8 per cent. of the consumers' price.

The milk distribution trade in the United States has long been well established and financially powerful, and it is hardly a surprise that the progress of co-operative milk marketing has been marked by many violent struggles with the existing privately owned distributive undertakings. The first stages in the development of the co-operative movement have been almost

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\* Cmd. 1854, price 3s. net, 3s. 1½d. post free. Obtainable from H.M. Stationery Office, Kingsway, W.C.2.

exclusively confined to the formation of producers' collective bargaining associations. Such associations did not, however, meet with unqualified success. A bargaining association which sold its milk to private dealers seldom found it easy to conduct business without creating hostility amongst the distributors. Moreover, they did nothing to overcome the real economic wastefulness of the existing system.

Nevertheless, much of the initial work of organising co-operative milk marketing was done by these associations. Between 1887 and 1889 there was a very rapid development of the movement amongst farmers towards the formation of associations for the collective sale of milk, and a further impetus was given to it during the last decade of the 19th century. Most of these organisations actually came into being to "fight the Milk Trusts" which operated in the principal cities of the United States, and their early efforts were frequently accompanied by violent disputes, "Milk strikes," and other disturbances.

As in most other branches of agriculture in America, by far the most widespread movement in co-operative milk marketing occurred during and after the War. In the neighbourhood of nearly all the large cities of the United States which have a population of 200,000 or over, co-operative milk selling associations were formed by local producers during the years 1915-1919. They were very different in form and in the objects at which they aimed, from the co-operative marketing organisations which have been developed in the orange trade in California, in the dried fruit trade, in the tobacco industry, and other branches of agriculture. They still consisted primarily of bargaining associations, which fixed prices by the system of meeting the distributors, and attempting to come to an agreement. No attempts were made at these early stages to control the market on the lines of the Californian Fruit Growers, or to carry out the final stages of distribution under the direct control of the co-operative organisation. Their success was the kind of success that generally attends collective, as contrasted with individual bargaining. They did in fact obtain a better price for milk for the individual producer than he had been able to secure by his own unaided efforts, but not without serious opposition from private interests. Like other organisations for collective bargaining, their ultimate weapon was to strike, and some sensational milk strikes of this character actually occurred during the war period in Chicago, Boston and New York.



(1).—An example of this type of organisation is afforded by the Twin City Milk Producers' Association, which was founded in 1916. In its early stages it was successful in obtaining for its members a definitely higher price for milk than generally prevailed in neighbouring unorganised districts; but it was soon recognised that the plan of collecting bargaining only went a small distance in solving the problem, and in December, 1919, a Stock Co-operative Society was formed with a capital of \$500,000 to provide plants to manufacture the surplus milk into various milk products. At the present time the Association has 4,200 members, most of whose dairies are within 40 miles of two cities, St. Paul and Minneapolis. It handles 80 per cent. of the milk of the district. The organisation embodies the usual principle of long term contracts under which all its members are bound to deliver their production of milk and cream, other than home requirements, to the Association. The milk is delivered each morning to a Receiving Station or plant of the Association, the amount needed by dealers being usually specified by means of contracts with the Association to take a stated amount of milk daily. A small surplus is retained for emergencies, and the balance remains at the country plants and is manufactured into cheese, butter, and other milk products.

This Association within its limited sphere has made very considerable progress. In 1921 it handled approximately 14 million gallons of milk, of which over 9 million gallons were sold to distributors, the bulk of the remainder being manufactured. Although the Twin City Milk Producers' Association confined its activities within the sphere indicated above, indirectly it led to the development of a further stage towards the co-operative control of distribution. The milk "drivers" of Minneapolis organised the Franklin Co-operative Creamery Association, to carry out the distribution of the milk from the Producers' Association, and to operate in conjunction with it. After starting with only 18 delivery wagons, by the spring of 1921 it had grown to 130 wagons delivering in all approximately 50 per cent. of the milk supplies of Minneapolis.

(2).—The most important co-operative milk marketing organisation in the United States is the Dairymen's League Co-operative Association (Inc.) of New York, one of the largest co-operative enterprises in America. It was organised in 1921, and during the first year of its existence, handled about 250 million gallons of milk, in return for which it distributed some 52,000,000 dollars amongst its members, who number approximately 65,000. At the end of March, 1922, the Association was

operating 123 manufacturing plants, and its members were organised at 944 receiving stations. During the latter year, the turnover of the Association amounted to approximately 6,000,000 dollars per month.

The Dairymen's League Co-operative Association succeeded an organisation known as the Dairymen's League, which was inaugurated as far back as 1907, primarily as a producers' protective association. In 1916, the latter body came into conflict with the New York Distributors, and after a short but severe struggle, succeeded in establishing working arrangements for its produce. Between that year and 1921, the Dairymen's League Co-operative Association (Inc.) began to handle the milk of more than 50,000 farmers under contracts which enable it to pool all its members' milk produced for market. The Association was empowered to dispose of the milk to distributors or to manufacturers of butter, condensed milk, cheese, ice cream, etc., or to manufacture it in plants owned by the Association. The producers at each of the 944 established points are organised into local corporations, existing primarily for the purpose of facilitating co-operative purchases of feeding stuffs and supplies, and for representation purposes in the Association.

The Association, like many similar co-operative undertakings in the United States, is a non-stock organisation, which is incorporated under the Co-operative Laws of New York providing for marketing associations formed on this plan. It is governed by 24 directors, each of whom represents a district.

The existence of farmer-owned milk depots, operated by experts in the employ of the Association, insures that there is no artificial interference with, or closing down of, the plant, as long as the farmers have milk to sell. It means that surplus milk is manufactured into the more advantageous forms of milk products, and is not shipped to the cities, as in former days, to force down the price of fluid milk received by the producer. The effect is that the milk market is stabilised to a greater degree; and in consequence a better price is assured to the farmer.

The Association returns to its members all the proceeds from the sale of milk, less the expenses for administration, and deductions for new plants and working capital. Each member receives the same base price per 100 lb. of milk, but with differentials for freight, butter fat, and hygienic quality, by means of 12 monthly milk cheques. Whatever is left as a residue of the year's business, goes to the members in a thirteenth cheque. The method of financing the Association, is to take certain



amounts each month from the returns to producers, and to issue interest-bearing certificates of indebtedness due in 5 years. During the first 11 months of the Association's life more than 5,000,000 dollars were thus retained, to be used by the Association for the purchase and equipment of plant, etc.

(3).—A third example of a similar organisation is the New England Milk Producers Association, a non-stock organisation incorporated under the laws of Massachusetts. Its general structure is not unlike that of the Dairymen's League Co-operative Association (Inc.). Primarily it is a bargaining association. It has, however, one or two distinctive features. The problem of surplus milk is handled according to a plan devised by the Federal Milk Commission during the War—a plan which has been continued since that time by agreement between the producers and dealers. In effect, this arrangement leaves the surplus milk to be handled by the dealers, the price paid by the dealers depending on the use to which it is put. The Association and the dealers, in the first instance, come to terms as regards the price which is to be paid for the milk used in the regular trade. The price of milk used for other purposes is determined by other factors which have to be agreed upon. The dealers report to a disinterested party each month, indicating the amount of milk which is produced and the amount of by-products made. This party—at present the Commissioner of Agriculture—computes, in accordance with an approved system, the amount of milk represented in by-products, and the price; the remainder represents the milk used in the whole milk trade, and for which the price which had been arranged by the Association and dealers, is paid.

(4).—An instance of a more advanced development on co-operative lines is afforded by the combined enterprise of the Frazer Valley Milk Producers Association, and the Frazer Valley Dairies, Ltd. The former comprises 1,800 dairymen, whose farms are situated in the valley of the Frazer River, and supply milk to Vancouver. The Association, which has a capital of 750,000 dollars, and deals with 90 per cent. of the milk in this district, receives the milk from its members under continuous contracts, which can only be revoked after one year's written notice. About one-fifth of its capital is used to finance the construction and equipment of condenseries, creameries and cheese plants handling the milk which is not supplied direct to Vancouver; a "surplus" plant situated in Vancouver deals with the seasonal fluctuation in the Association's milk supplies,

while the remainder of its capital is used in the subsidiary organisation, the Frazer Valley Dairies, Ltd. The Association sells its fluid milk both to the latter and to some other distributors, the Frazer Valley Dairies, Ltd. buying its milk from the Association at prices fixed by the latter. It distributes 65 per cent. of the Vancouver milk, and returns the bulk of its profit to the parent Association. It has been stated that the costs of this distributive organisation have been very low, and the result of the combined arrangement has been to ensure to the milk producers a substantially larger proportion of the consumers' price than had previously been the case.

**Note.**—It is perhaps not without interest to compare the progress made in co-operative milk marketing in the United States with other branches of the co-operative movement, a short account of which was given in the January issue of this *Journal*. It is easy to see that in the case of milk one of the chief problems still remains unsolved. Co-operation has done little to gain control over the retail distribution of fluid milk in the towns, or to reduce the cost of this service. One of the difficulties in the development of the retail side of the business is not far to seek: the capital required for distribution in large cities is very great, and the characteristic of American co-operative enterprise is that it is usually operated on very little capital, the non-stock non-profit association being the common type. A second difficulty is the highly organised state of the existing retail business and the high degree of technical skill required in its management. Nevertheless, many authorities consider that the co-operative sale of milk by farmers and its retail distribution by ordinary dealers is not a satisfactory combination, and it seems probable that the next few years will see the development of co-operative enterprise in retail milk distribution in the United States.

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## EARLY ESTIMATES OF GRAIN GROWING IN GREAT BRITAIN.

PERSONS interested in the history of British Agriculture often wish to obtain some early statistics of the acreage and production of crops in this country before such statistics were officially collected in 1866-67. The following note gives such information on this subject as is available.

The most detailed estimate of the distribution of agricultural land in England available at the beginning of the 19th century was one made about 1771 by Arthur Young in his "Tour



through the East of England." No great value can, however, be attached to his figures as they were based on the mistaken assumption that the total area of England and Wales amounted to about 47 million acres, whereas more correct measurements subsequently showed an extent of only 37,324,000 acres. As, however, he is the only writer of the period who attempted to estimate the production of grain, the figures have some interest as showing his opinion of the supplies available at that time from home sources. The figures are as follows:—

				ENGLAND.	
				Area.	Production.
				Acres.	Quarters.
Wheat	...	..	...	2,795,008	8,385,024
Barley	...	...	...	2,623,885	10,495,540
Oats...	...	...	...	1,483,065	7,044,558
Peas	...	...	...	513,369	1,475,935
Beans	...	...	...	399,287	1,647,058

In 1797 Mr. Middleton, in a Report on the State of Agriculture in Middlesex prepared for the old Board of Agriculture, made an estimate of the proportion of each 10 million acres of arable land occupied by the different crops, founded, he says, "on my own observations in most of the counties of England." He followed, however, Arthur Young in calculating the total area of England and Wales at 47 million acres and placed the arable acreage at 15 millions. Dr. Beeke in 1800 (*Observations on the Produce of the Income Tax*), taking the total area at 38,500,000 acres, reduced Middleton's arable estimate proportionately to 11,491,000 acres; and Mr. W. T. Comber in *An Enquiry into the State of National Subsistence* (1808) seems to have applied Middleton's proportionate figures to this area and arrived at the following result:—

					Acres.
Wheat	...	...	...	...	3,160,000
Oats and Beans	...	...	...	...	2,872,000
Barley and Rye	...	...	...	...	861,000

McCulloch in the edition of his *Statistical Account of the British Empire* published in 1837 gives figures of the average yield per acre of the undermentioned crops, deduced from the county surveys of the old Board of Agriculture made between 1793 and 1815. These may be compared with Arthur Young's estimate adopted in the table of production given above:—

				Board of Agriculture Surveys.	Arthur Young's estimate, 1771.
				Bushels per acre.	Bushels per acre.
Wheat	...	...	...	21	24
Barley	...	...	...	32½	32
Oats...	...	...	...	35½	38
Rye ...	...	...	...	23¾	—
Peas	...	...	...	23	23
Beans	...	...	...	25¾	33

Applying the Board's figures to Mr. Comber's estimate of the wheat acreage the production of that crop at about the beginning of the nineteenth century would seem to have been about 8,400,000 quarters.

In the case of Scotland, an estimate of the area under cultivation was made in the General Report on Scotland published by the Board of Agriculture in 1814. No figures were given of production, but the area of the principal crops was as follows:—

	•Acres.
Wheat ... ..	140,095
Barley ... ..	280,193
Oats ... ..	1,260,362
Rye ... ..	500
Beans and Peas ... ..	118,000
Potatoes ... ..	80,000

If the wheat yield of Scotland is taken at the same figure as England, viz., 21 bushels per acre, the production of wheat in Scotland would be 368,000 quarters, making a total for Great Britain of 8,768,000 quarters. This may be compared with the statement of Tooke, in his *History of Prices*, that the produce of an ordinary crop of wheat in this country at the beginning of the last century was estimated at nearly 9 million quarters.

In 1814, however, Arthur Young in giving evidence before the Select Committee on Petitions relating to the Corn Laws made an estimate on a rather different basis, and gave a figure for the production or consumption of wheat, barley and oats in the United Kingdom. His calculation was as follows:

ENGLAND AND WALES:	Qr.
Out of a population of 10,791,000, 8,500,000 persons consumed wheat as bread at the rate of one quarter per annum ...	8,500,000
Consumption not as bread ... ..	100,000
...	8,600,000
Less net imports (average of 1811—1812) ... ..	187,162
...	8,412,838
Add for seed, one-ninth ... ..	934,759
Annual growth=3,399,126 acres at 22 bushels per acre	9,347,597
Barley and oats, occupying half as much land again as wheat, would represent 5,098,689 acres at 36 bushels	22,944,100
SCOTLAND:	
Wheat (? barley) and oats (consumption) ... ..	5,401,283
IRELAND:	
Wheat (? barley) and oats (consumption) ... ..	3,375,000
Total production of wheat, barley and oats in the United Kingdom...	41,067,980

“Oats,” he observes, “are much consumed in Scotland, the amount in quarters much exceeding the consumption of wheat per head.” In regard to Ireland, the basis for the support



of the population was the potato, and he allows 18 bushels per head of wheat and oats for 1½ million persons as representing the total consumption of a population of 5 millions.

The importance of wheat as the principal food stuff of this country, and its extremely high price in some of the years between 1800 and 1815, caused great attention to be given to facts relating to its cultivation and importation, but it does not appear that up to the year 1816 any attempt was made at a quantitative annual estimate of the amount available to meet the requirements of the population. As late as 1821 the Select Committee on the State of Agriculture assumed "what they believed to be then true," that the annual produce of corn, the growth of the United Kingdom, was upon an average crop about equal to the annual consumption.

Subsequently in 1828 an estimate was made by Mr. Jacob, Inspector-General of Corn Returns, in his Second Report, made to the Board of Trade, on Agriculture and the Trade in Corn in Northern Europe, 1828. He put the annual consumption in Great Britain, exclusive of seed, at 12,000,000 qr. and estimated the quantity of the produce according to a scale "based upon extensive inquiries." He also at the same time made an estimate of the supply and demand for the years 1816 to 1827, which it may be interesting to reproduce:—

Year.	<i>In thousands of qr.</i>						<i>Price per qr. in Harvest year.</i>	
	<i>Stock in hand.</i>	<i>Imports.</i>	<i>Produce.</i>	<i>Total available.</i>	<i>Estimated requirements for food and seed.</i>	<i>Stock remaining in Hand.</i>		
1816	6,150	772	9,000	15,922	12,480	3,442	s. 97	d. 10
1817	3,442	1,739	11,700	16,881	12,670	4,211	84	6
1818	4,211	733	12,000	16,944	12,850	4,094	78	5
1819	4,094	403	12,500	16,997	13,030	3,967	68	5
1820	3,967	567	16,000	20,534	13,210	7,324	57	0
1821	7,324	463	12,600	20,387	13,390	6,997	50	5
1822	6,997	400	13,500	20,897	13,570	7,327	46	4
1823	7,327	367	11,000	18,694	13,750	4,944	59	9
1824	4,944	411	11,500	16,856	13,900	2,956	64	6
1825	2,956	811	12,700	16,467	14,110	2,357	61	1
1826	2,357	701	13,000	16,058	14,290	1,768	56	1
1827	1,768	957	12,500	15,225	14,470	755	53	2

In regard to this statement Mr. Jacob observed: "No one can be more aware than myself of the errors to which an implicit confidence in the preceding table would lead. . . . It may, however, deserve a considerable degree of attention as a clue to the development of some important views. . . . The relative productiveness of the several years, being framed from as great a variety of facts as could be collected is not

likely to be very far from an accurate view. The statements relating to absolute quantities are certainly only unauthoritative conjectures. There are no satisfactory notices in this country of the number of acres destined to grow bread corn nor even of the number under arable cultivation. There are no means of forming any judgment of what the average acreable produce of wheat is. . . . It is equally difficult to determine what is the annual consumption; in the table it is estimated at somewhat more than 6 bushels and a half per person."

McCulloch in his *Statistical Account of the British Empire* (1854) gives an estimate for the year 1846, as follows:—

	England and Wales.			Scotland.	
	acres.	qr.		acres.	qr.
Wheat ...	3,800,000	15,200,000	...	350,000	1,225,000
Barley ...	1,500,000	6,375,000	...	450,000	1,800,000
Oats ...	2,500,000	12,500,000	...	1,300,000	6,500,000

About this period, the demand for statistical information as to production developed, and the apprehension of an impending famine in Ireland in 1847 led to the systematic collection in that country of returns both of acreage and produce. In 1853, and in several subsequent years the Board of Trade, at the suggestion of the Highland Society, attempted as an experiment the collection of agricultural statistics both in England and Scotland. An estimate was made in 1854 for the whole of England and Wales on the basis of reports obtained by Poor Law Inspectors from 11 counties. In the case of Scotland, complete returns seem to have been obtained in 1855, 1856 and 1857.

According to these estimates, the acreage of grain and potatoes in England and Wales in 1854 and in Scotland in 1855 was as follows:—

	England and Wales.				Scotland.
	(1854)				(1855)
	acres.				acres.
Wheat	...	...	3,808,000	...	191,000
Barley	...	...	2,668,000	...	186,000
Oats ...	...	...	1,303,000	...	934,000
Potatoes	...	...	192,000	...	147,000

Estimates were also made by Sir John Lawes as regards the wheat acreage and production of the United Kingdom from 1852-53 (see *Journal of the Royal Agric. Soc.*, 1893). In 1866, the official collection of statistics of the area of crops and number of live stock was commenced, but it was not till 1881 that this was supplemented by official estimates of production.



## HOUSING OF CASUAL LABOUR.

MISS E. H. PRATT, O.B.E.,

*Ministry of Agriculture and Fisheries.*

IN the issue of this *Journal* for July, 1919, there appeared a most interesting account of the starting and development of raspberry cultivation in the neighbourhood of Blairgowrie. The author of that article, Mr. J. M. Hodge, has since dealt with the whole subject in a still more comprehensive manner in "Raspberry Growing in Scotland."\* This book contains a record of past achievement and a survey of future possibilities, and the whole position is reviewed from every standpoint—agricultural, economic and national. In the course of a recent visit to the raspberry growing districts of Perthshire, undertaken with the object of gaining some insight into the conditions under which Scottish fruit pickers live and work, much help was derived from Mr. Hodge's written narrative, in which adequate consideration is given to the problem of labour. The additional information furnished in person by Mr. Hodge and Mr. Keay (who has also had much to do with these fruit-growing enterprises), contributed materially to understanding of the present situation. Viewed in the light of past history, existing arrangements at Blairgowrie illustrate the continuous progress which has been made in the matter of accommodation for casual labour.

In endeavouring to give some brief description of the housing of such seasonal workers in Perthshire to-day it will be convenient to deal (1) with properties in individual ownership, and (2) with those in joint ownership.

Mr. Hodge's statement shows that raspberry growing, on a commercial scale, started in a small way at Blairgowrie in the closing years of the 19th century. At first the labour problem was practically non-existent, for the villages yielded a sufficient supply of pickers. As the area under fruit cultivation steadily increased, it became evident that it would be necessary to import labour for the harvest season, and the "housing question" became acute. It is related that one enterprising grower "erected corrugated iron buildings, fitted with wooden beds and supplied with straw and blankets. Others followed his example and the fields became dotted with more or less respectable sheds for the housing of the pickers." With some slight modification this would still apply to the provision for seasonal labour made

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by the average individual grower in raspberry growing areas to-day, if establishments recently visited by the writer may be regarded as typical.

**Accommodation Provided by the Smaller Growers.—**

*Camp I* catered for a relatively small number of pickers and the accommodation was correspondingly limited in extent and character. The buildings, of corrugated iron, included mess-room, kitchen and sleeping huts. The latter contained wooden beds (fashioned on the lines of bunks), filled with loose straw and provided with army blankets, fumigated at the end of the season. Two persons slept in each bunk. Ablutions were performed in buckets with water from taps outside the huts. Earth sanitation was available. A good fire was kept burning in the kitchen stove, where the kettles were boiled. The messroom was small and bare, but as the camp was near Blairgowrie there was no difficulty about the purchase of provisions. An attendant exercised general superintendence over the camp. While primary needs were satisfied at this camp, it was felt that it represented the minimum of comfort and that the standards of order and cleanliness might, with advantage, have been higher.

*Camp II* instanced progressive improvement. More workers were located there, and the buildings, though resembling those of Camp I, were of greater capacity. The rooms were larger and lighter, and the general "lay out" more satisfactory. Sleeping accommodation took the form of large dormitories for single men and single women respectively and of separate compartments for families. These huts were also fitted with wooden beds of the usual box-like design, plentifully supplied with straw. Lockers, whose tops could be used as tables, were a new and useful feature of the furnishing. Sanitary provision for the men adjoined that for the women, but, by order of the local Sanitary Officer, entirely separate arrangements were to be made in the future.

*Camp III*, the property of a local landowner, proved to be the scene of a special experiment. Between 20 and 30 women, students from Glasgow and Edinburgh, secure a cheap and pleasant holiday every year by undertaking the picking of fruit at this particular plantation. Excellent wooden buildings, with good floors and a plentiful supply of windows, have been erected for their reception. A large and pleasant room was in use as combined kitchen, pantry and messroom. The services of a cook are retained throughout the season and 12s. per week is



all that the pickers are called on to contribute in return for their comfortable quarters and good food. The spacious dormitory was lined, on either side, with a double row of bunks, and personal property was placed on a long narrow table or form, fixed in the middle of the hut. Connected with the hut was a bathroom containing lavatory basins and two baths, the hot water for which was fetched from the kitchen boiler. There were three w.c.'s. The camp as a whole was a very pleasant example of the satisfactory arrangements which can be made when a limited number of persons of a selected type are employed year after year.

At *Camp IV* a two-storeyed wooden building had been put up for the accommodation of a small number of special pickers (e.g., Girl Guides and others). In this case the ground floor was used for messroom, kitchen, etc., and the upper storey as a dormitory. Here again it was clear that temporary quarters can be made very comfortable indeed for a small and homogeneous body of pickers.

*Adapted Farm Buildings.*—In the foregoing instances the buildings had all been erected specially for housing purposes. An instructive visit was paid to a larger farm some miles from Blairgowrie, which may be described as *Camp V*. This exemplified the adaptation of ordinary farm buildings on a large scale and illustrated the special arrangements which remoteness of situation entails. While the floors of the older buildings were necessarily rough, the cleansing and whitewashing of walls had helped to produce a habitable atmosphere in places originally designed for very different uses. Space available in the lofts and ground-floor buildings already existing had been supplemented by a large hut of corrugated iron. The men's quarters were separated from those of the women. The usual type of wooden box-bed, raised well above the ground, was installed throughout the dormitories and completed by straw mattresses and blankets. Ablutions were performed in pails, and earth sanitation was arranged.

Two pleasing features of the encampment, which went far to alleviate the difficulties otherwise inseparable from an isolated situation, were the canteen provided by the owner and the recreation tent organised by the Church of Scotland. The former was a large room built of corrugated iron with concrete flooring and good lighting, which served as a combined kitchen and messroom. Such of the pickers as did not cater for themselves could buy cooked food (soup, potatoes, etc.), and eat it

there. A grocery store was also open in the canteen, and so everything essential to the pickers' housekeeping was obtainable on the premises. The large tent, furnished with forms, benches and piano, and provided with magazines, etc., was in charge of a neighbouring Minister of the Church of Scotland. Camp V stands out in memory as an example of the way in which ordinary farm premises may, with extensions, be utilised to meet the requirements of a new industry springing up on the land.

**Larger Schemes of Accommodation.**—*Essendy.*—Turning to conditions on lands in joint ownership, the first ambitious housing scheme on co-operative lines was inaugurated at Essendy, an estate some miles from Blairgowrie, in 1905. Appreciation of the fact that raspberries cannot be grown continuously on the same land has now resulted in temporary discontinuance of fruit culture at Essendy, and only a small proportion of the buildings there are in use at present. The scheme, however, remains, even in a state of partial disuse, an impressive contribution to the solution of the problem of housing casual labour. It is surprising that accommodation so extensive and of so excellent a type could have been erected at a cost which, even allowing for pre-war prices, was so inconsiderable. Between 1905 and 1908 the sum of £3,441 was disbursed for housing at Essendy—a comparatively small sum when the character and capacity of the settlement is taken into account.

Some re-distribution having been found necessary, the buildings are now grouped in two main portions in beautiful surroundings on a tract of moorland sloping down to Marlee Loch. The fruit fields are readily reached from one or other of these groups; such accessibility was indeed found to be essential to any satisfactory housing scheme. The accommodation comprises a large number of sleeping huts, each capable of holding 20 persons. All these huts are of substantial appearance, some being built of brick, others of corrugated iron. By judicious management, it proved possible to erect the former at a cost of £75, the latter at £50 per hut in pre-war days. At the end of each a small room or recess fitted with basins makes an admirable ablution room, and the shelter and privacy thus secured must be greatly appreciated. Earth sanitation is provided. The three spacious canteens, built of corrugated iron with excellent lighting and flooring, are greatly in advance of previous standards of accommodation for the agricultural worker.



When not required for meals, they are used as recreation rooms. The canteens are served by well-planned kitchens, equipped with suitable stoves and boilers and well provided with larder and storage space. The general arrangements are such as should secure quick and efficient service of meals. Grocery and stationery stores are maintained (though now on a diminishing scale) on the premises and regulated by a system of ticket distribution.

In the heyday of raspberry growing at Blairgowrie it is related that a matron and thirty servants attended to the material wants of the pickers, that a doctor, cleansing officer and a policeman ensured their health and safety, and that week-day concerts and religious services on Sunday ministered to recreation and spiritual welfare. "Add to these things," says Mr. Hodge, "that the settlement housed the pickers of all the growers on co-operative lines, each grower having a *pro indiviso* interest in the buildings in proportion to the acreage of ground he owned; that the pickers were secured not for the individual but for the associated growers and allocated among them according to their needs; and that the produce of the colony was sold by a salesman appointed for the purpose, and you have a scheme which as far as I know has no counterpart . . . ." The visitor from England, contemplating the adequacy and attractiveness of the whole design at Essendy, appreciating the sound and sensible lines on which it has been carried out, and realising the good sense and vision, the regard for real efficiency and ultimate economy which prompted both conception and execution can only echo the regret that so satisfactory a scheme has not been more widely copied as yet in the south.

*Aberuthven: The Latest Development.*—At Aberuthven, in the Parish of Auchterarder, on the estate of the Hall Farming Company, it proved possible to see, under the guidance of Mr. Neil Young, the manager, what may be regarded as the latest example of Scottish schemes for housing such casual labour. Raspberry cultivation is at its height at Aberuthven and the activity there is comparable to that which existed in earlier times at Essendy. Experience gained at the latter place has proved of value in developing Aberuthven. It had become apparent that pickers must be near their work, and it was further understood from the outset that, as the amount of labour required would be large, workers of differing types would need to be considered. As a result there are eight housing centres on the 400 acres now under raspberries. At the time of this visit there

were over 1,000 pickers (chiefly coming from Glasgow) in residence, and it was expected that this number would be very considerably exceeded during the six weeks which constituted the season. Of the eight centres, three were allocated to industrial schools, four to women and children and one to men.

These eight camps at Aberuthven are all delightfully situated and are mostly specially built, though there is one case of adapted buildings (lofts, etc.). The usual building is of corrugated iron, with numerous windows and good wooden floors. The sleeping quarters consist of huts, equipped with 9 beds (of the wooden box variety), straw-filled mattresses and army blankets. Since each bed holds two people, 18 were housed in each hut, but the local Sanitary Officer is now limiting the residents to 13, in accordance with a bye-law which provides that accommodation erected in the future shall allow 300 cubic feet of air space per person.

Drying rooms are provided for the pickers' wet clothing. Ablutions are performed in pails with water obtained from adjacent taps or streams. Sanitary conveniences (on the pit system with use of disinfectants), are provided at each centre in the proportion of one to every twenty residents. There is a matron in charge at each camp, who is responsible for order, cleanliness and general discipline. Her own hut is part of the camp in question.

Each centre includes a canteen (capable of holding about 300 people), built of corrugated iron with a good floor, which is a feature of these Scottish housing schemes, and furnished with wooden tables and forms. Kitchens and store-rooms adjoin each canteen. Each kitchen also serves as combined pantry and scullery and is fitted with a concrete floor and equipped with kitchen stove, sink and everything necessary for culinary purposes. At each canteen there is a staff of one cook and 4 helpers and a clerk in charge of tickets, etc. Both meals and dry goods (bread, etc.), are sold on the ticket system. No special arrangements for recreation are now in force at Auchterarder, but a doctor visits the estate on three days of the week and can be fetched at any time by telephone.

It is a striking fact that, at pre-war prices, practically the whole of the pickers' houses and their furnishings at Auchterarder seems to have been secured for the sum of £8,000—approximately £1,000 per centre. The settlement there certainly represents a landmark in the evolution of housing schemes for casual labour. The system of decentralisation, whereby the



inhabitants are distributed into 8 camps, each complete, self-contained and under superintendence of a special official, marks a noteworthy advance and has gone far to solve the problem of dealing with diverse classes of seasonal workers.

Difficulty has been experienced from the beginning in obtaining a sufficient supply of suitable harvest labour. Industrial school children are extensively employed, but at present the bulk of the labour is apparently casual women workers from the towns. It will never be easy to secure adequate supplies of labour, owing to the difficulty of securing fruit-growing land near the towns and the fact that in fruit growing, as practised in Scotland, there is little diversity and hence the season is very short.

These considerations have evidently influenced the development of the housing schemes which have been outlined in this article. Scottish growers have been led to take a comprehensive view of the problem. In this respect, the co-operative character of such enterprises as Essendy has no doubt contributed largely to a satisfactory solution. It is a fair assumption, having regard to that flair for practical affairs, traditionally ascribed to Scotland, that the Scottish grower's provision for his workpeople is not philanthropy but a sound business proposition. It is recognised that suitable provision must be made if workers of decent type are to be attracted and retained, and if proper control is to be exercised while they are in residence. The erection of housing accommodation is regarded as an essential part of capital outlay. The latest Scottish camps for pickers are expressions of a wise policy, designed to secure true economy, and it is greatly to be hoped that standards in this country may approximate more and more to those attained at Auchterarder.

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## THE CO-OPERATIVE MARKETING OF EGGS.

MAJOR H. D. DAY,

*Chairman, Stamford and District Co-operative Egg and  
Poultry Society, Ltd.*

As one of those who gave evidence before the Linlithgow Committee, the writer feels that the following account of the working and organisation of a small co-operative distributing society dealing solely with eggs may be of interest.\*

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\* See also "A Successful Egg and Poultry Co-operative Society," this *Journal*, May, 1922, p. 171.

The standard of egg sold off the general farm is not by any means good, and this is abundantly proved by the fact that last year the Stamford Society removed 2,321 *bad eggs* from those collected. One of the principal objects of a co-operative egg-collecting society is the elimination of all eggs not up to standard from those sold as best English new laid. How this is effected by such a society when properly run is described below.

**Method of Working.**—The society described is the Stamford and District Co-operative Egg and Poultry Society, Ltd., and is affiliated to the Agricultural Organisation Society. Its Headquarters are a shop and premises in High Street, Stamford, and the district from which eggs are collected is roughly a radius of nine miles from this centre.

The collecting area is divided into five journeys, which are worked as follows:—Monday, 2 journeys; Tuesday, 2 journeys; Wednesday, 1 journey. All eggs are taken to the centre, where they are sorted, tested and repacked for delivery on Thursday and Friday, leaving the vans idle on Saturday for cleaning and overhaul.

The eggs collected are mainly paid for in cash by the collector who enters the transaction in a counterfoil book which both he and the member sign, thus making a receipt both ways. The original is held by the member and the carbon copy kept by the society. A few of the larger producers prefer a monthly payment, and their accounts are paid monthly by cheque on the first Friday in the month.

On arrival at the depot the eggs are unpacked, and all dirty, undersized and duck eggs are sorted out from the bulk of first-quality eggs. They are then candled, and all stale, cracked or otherwise imperfect eggs eliminated. As perhaps the candling of eggs, though one of the simplest processes in the world, is not known to all, it may be mentioned that it merely consists of holding the egg before an aperture—of about the same size as the egg—through which a bright light shines into a darkened room. The degree of transparence decides the freshness of the egg, and cracks or blood spots are easily seen.

After this sorting and testing, the eggs are sold by the manager, mainly to the retail shops in Nottingham, though about 3,000 to 5,000 per week are retailed over the counter in the shop in Stamford. These sales are as far as possible arranged on the Saturday, for delivery on the Thursday and Friday following. Being thus arranged before the eggs are collected, the fixing of the price to be paid to the producer



becomes a simple matter. Delivery of the eggs is made by the same vans which do the collecting earlier in the week.

The use of motor transport has the following advantages.—

(1) The Society's own man sees the buyer, often collects the actual cash and brings back empty cases;

(2) It does not matter how small a consignment is left at any one shop, and many of the smaller shops pay the better price;

(3) The manager is in close touch with customers, as he can often go over on the van with the eggs;

(4) The careful packing required when eggs are sent by rail is avoided;

(5) By avoiding transhipment the cases last much longer;

(6) Motor transport is much more economical and speedy than the railway.

**History.**—The Society was formed in September, 1916, as the outcome of the collection of eggs for the military hospitals. It started business with the assistance of the Agricultural Organisation Society in quite a small way, collecting eggs with a pony and trap.

The first motor van was purchased in the third year and the second in the fifth year (1920), and both these are now fully employed. The following table shows the position of the Society as shown on its annual balance sheets for the seven years of its existence. The profits shown are gross :—

<i>Year.</i>	<i>Capital.</i>			<i>Turnover.</i> (approx.)		<i>Profit.</i> (gross.)		
	£	s.	d.			£	s.	d.
1916-17	132	12	6	...	3,750	...	216	17 3
1917-18	281	10	0	...	9,200	...	488	4 2
1918-19	352	12	6	...	12,250	...	285	6 8½
1919-20	382	10	0	...	16,500	...	131	12 11½
1920-21	444	10	0	...	16,350	...	42	13 11
1921-22	459	12	6	...	10,150	...	—	2 9 5½
1922-23	413	15	0	...	9,680	...	198	14 11

Unfortunately, the turnover in eggs for each year cannot be given, but for the past 3 years it has been approximately: 1,225,000 eggs in 1920-21, 1,080,000 eggs in 1921-22, and 1,257,000 in 1922-23.

This shows how the value of the egg has fallen since 1921 as, though the collections for that year were less than 1923 yet the actual value was much higher.

The position as disclosed by the balance sheet for 1922-23 is very sound, as the *cash* assets of the Society at the end of the financial year (6th September, 1923) were more than sufficient to cover the capital and other liabilities.

**Seasonal Fluctuations.**—Though the number of eggs dealt with varies greatly from month to month (the maximum for the past financial year being 43,300 eggs in the last week of March, 1923, and the minimum 8,550 eggs in the middle week of November, 1922) it is noticeable that the average value of the weekly collection only varied during the same period from a maximum of £240 in February, 1923, to £170 in July of the same year.

*Eggs Collected and Prices Paid in 1922-23.*

<i>Month.</i>	<i>Average Weekly Collection.</i>	<i>Average Price per doz.</i>	<i>Average Value of Weekly Collection.</i>
		s. d.	£
September, 1922 . . .	17,750	2 2	200
October " . . .	12,750	2 9	175
November " . . .	10,300	3 6	180
December " . . .	15,900	2 8	215
January, 1923 . . .	19,750	2 3	220
February " . . .	29,200	1 8	240
March " . . .	33,500	1 3	210
April " . . .	35,000	1 0	175
May " . . .	37,300	1 1	200
June " . . .	34,150	1 2	200
July " . . .	27,100	1 3	170
August " . . .	20,800	1 9	175
Average per week for the year . . .	24,450	1 7½	£197 10 0

The price given here is that actually paid to the producer, and it should be noted that this includes all eggs bought, covering all bad, cracked and small eggs. The actual price received by the society was 22.15d. per doz. and a bonus of 3d. in the pound was paid to members.

**Organisation.**—The staff consists of a manager, a collector and the collector's wife. The manager is controlled by a Committee of Management which meets regularly on the first Friday in each month, and two members of the Committee are detailed at such meetings to attend on the intervening Fridays to sign cheques and settle any general business the manager may bring before them.

The manager is also the secretary, and his duties mainly consist in marketing the eggs collected and keeping the books. He also works a collecting round on Monday and Tuesday. His salary is augmented by a bonus on eggs collected and a share in profits.

The collector's duty is to collect eggs on three days of the week and deliver them on other days; he also helps with testing and packing, etc., when at headquarters. His wife runs the retail shop and does the bulk of the testing. Both of them share in any bonus.



*Transport.*—The transport consists of two covered Ford vans (*i.e.*, one small one and one one-ton truck). During the past year the vans have been run and kept in repair on contract by a local garage, and this has been found satisfactory. The driver being only paid for the days worked, one or two vans are used at a time as required, without the expense of keeping two permanent drivers.

*Book-keeping.*—The books used by this society are cash book, ledger, and two day books (one for eggs bought and one for eggs sold) and the Committee's report book. This latter is drawn up as follows and inspected weekly by the Committee:—

<i>Particulars.</i>	<i>Purchases.</i>		<i>Particulars.</i>	<i>Sales.</i>	
	<i>Eggs.</i>	<i>Value.</i> £		<i>Eggs.</i>	<i>Value.</i> £
Forward from past week	87,000	620	Forward from past week	88,000	720
Bought during week ...	20,000	160	Sold during week ...	18,000	190
Expenses to date £25 per week for 5 weeks ...	—	125	—	—	—
Total ...	107,000	905		106,000	910
			Stock in hand ...	800	
			Written off bad to date	160	
			“ “ „ for week	40	200
Total bought—107,000			Disposed of ...	107,000	
Bank balance—£320.			Debts owing to Society—£185.		

This shows the Committee exactly how things stand at the date of the meeting, and enables them to see at a glance the data required when fixing the buying price for the ensuing week.

**Finance.**—As regards the cost of running a society of this sort the first consideration is the capital outlay. For plant, etc., £450 should be sufficient, the principal items being two Ford vans, egg boxes (we use almost entirely second-hand colonial egg boxes, 360 size), cash register, books and office furniture. The working capital, *i.e.*, the price of two or three weeks' collection of eggs, should be obtainable on loan.

The actual running cost of this Society last year was £1,145. with the turnover of 1,257,000 eggs. This is a cost of 2.62d. per dozen eggs for collection, testing and transport to the actual retailer. Interest on capital, depreciation and bonuses to staff cost a further 0.46d. per dozen, depreciation being high as it is necessary to write off a large amount from the cost of the vans, which were bought originally at very high prices during the War.

**General.**—Co-operative depots ensure the marketing of high standard British eggs, as small eggs, etc., are graded out and sold as such. Last year 2,300 odd eggs out of a total of 1,257,000 (approximately 0.02 per cent.) were graded out as bad and

destroyed. The depots save the producer all expenditure on cases, transport charges, etc., as the eggs are collected from his door, and as they are sold direct to the shops, middlemen, except the actual retailer, are cut out. They require certain geographical conditions for success. If tried in areas close to good markets, where they are in fact unnecessary, the producers can usually get a better price by taking their produce themselves to shops.

Good markets should, however, be within motor reach, as this saves much extra expense in special packing for railway transport, while the motors also collect and bring back the empty boxes, so effecting a further saving.

A certain minimum and maximum number of eggs is also essential. For a depot of the size here dealt with, a minimum of a million and a maximum of a million and a half is necessary. A smaller number would mean higher marketing charges per dozen, and a greater number a larger staff and more transport, with the same result—unless the number were very much greater, in which case a second society might possibly be the best course.

If more societies are formed near the same markets, co-ordination of marketing by them should be organised, for their mutual benefit.

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## THE STOAT.

H. MORTIMER BATTEN, F.Z.S.

NATURE works in mysterious ways with regard to the stoat. No creature can be more timid and fearful of man, yet the stoat which streaks off at one's approach, gibbering terror, is as likely as not to turn like a rattlesnake and threaten unprovoked attack. One strange fact concerning this beast, which we regard as belonging essentially to our woods and hedgerows, is its occasional partiality to suburban gardens and even town dwellings, where cats parade at night time, and where the tread of human feet and the rumble of wheels are not the least disquieting sounds by day.

A stoat has been known to take up residence in a greenhouse or potting shed or similar outbuilding, where, becoming acquainted with the sight of human beings, it soon acquired indifference towards their presence.

I have from time to time received various records of this kind, but my own experience of the wild stoat is that it will



readily forsake its chosen quarters if the presence of man becomes too frequent. This one quickly learns when attempting to photograph it.

**Distribution.**—It is frequently said that stoats are entirely nomadic in their habits—that except when they have young to feed they are resident nowhere. This is not always the case. Certainly stoats come and go, and the covert which is to-day free of them may a fortnight hence be over-run. In my own locality, for example, there were no stoats at all so far as one could judge last April. An epidemic of distemper had cleared them out, but it was thought by the keepers that they would reappear when the young pheasants began to run. They did not reappear, however, till the end of June, and by the beginning of August they were as plentiful as ever.

So far as one can determine a family of stoats reared, let us say, in a certain wood will continue to hunt that wood till full grown, that is, till the end of August or into September. They may be seen at the same places day after day hunting or chasing each other, but with the first autumn gales a new restlessness comes upon them, and they disappear.

This seasonal restlessness among stoats, which begins with the first fall of the leaves and lasts a fortnight or so, has often attracted notice. The madness of the March hare is proverbial, but no March hare is madder than an early autumn stoat. With the hare, however, the phrase is understandable, as March is their mating season, but with stoats the sexual instinct is more or less dormant in autumn. Yet during a windy day, when the first leaves were whirling about the hedge bottoms and the woodland corners, I have seen more stoats in a forenoon's ramble than one is likely to see during the course of any other month—crossing and re-crossing the roads more or less heedless of traffic, and bounding fearlessly about the leafy banks, where their quick movements are easily passed for a drifting leaf.

At first glance this characteristic would seem to indicate migratory instincts, which would appear to have some bearing on the distribution of the species. It has already been said that the young haunt their home quarters till wild weather begins, when, in view of the lean months ahead, the instinct comes to them to find other quarters. So the first storm winds bring about an immense shuffling and re-sorting among the beasts which, all summer, have come little before our notice, owing to the sheltered and shut-in lives they have led. Some

of the families, to be sure, remain united into the winter, and family may join family till a pack is formed, but normally the families break up in early autumn.

But what about the new stock of stoats which turned up in my own locality during the month of July? To advance a theory would perhaps be rash, but I examined seven of these new-comers, everyone of which was an old dog—from which significant fact one is at liberty to draw one's own conclusions.

Summing up, then, I concluded that the mother and young haunt the vicinity of the nest till September or October. The male may or may not remain with his mate. In the majority of cases he does not, but lives a nomadic life the year round, and he is one of a great army of old males who, having been unable to hold their own against their own sex (or the opposite) have no family ties at all. The young begin to wander in autumn. Some of them become anchored by exceptionally good hunting, but the majority remain nomadic till they in turn have family ties. So we have at all seasons an immense number of nomadic stoats, in addition to those which, during spring and summer, escape notice by the retired lives they lead.

**A Stoat's Larder.**—At one time I had under close observation one of the many abandoned lead mines in the West Riding of Yorkshire, which were shut down thirty years or so ago. This particular mine is situated in the wild stretch of moorland country between Grassington and the valley of the Nidd, and wild life of all kinds finds sanctuary in the underground culverts and the immense masses of crumbling masonry.

One evening I saw a stoat run out of the furnace house with a frog in its mouth, and in the centre of the heavily paved washing floor it sat bolt upright, cutting a grotesque little figure as its elongated shadow fell across the flags. For fully a minute it sat without twitching a muscle, then with that spontaneous action peculiar to the weasel family, it dived through a chink in the flag on which it had sat. After a minute or so it reappeared from the same chink but without the frog, and having surveyed the landscape it darted off into the gathering gloom.

Thinking that the animal had its family under the flag, I went to some pains in rooting it up, and though there were no young stoats, my efforts were rewarded by the discovery of a genuine example of a stoat's larder. The frog most recently deposited was there alive, though it appeared to be paralysed by the scarcely discernible bite at the back of the head. There



was half a grouse egg which had lain exposed to more than one hill storm, since the colour was washed from its surface; a great deal of sheep's wool—probably bedding—a kippered worm, which must have been a veritable boa-constrictor in its best days, and a good deal of rabbit and mouse remains. There may have been other oddments, but I have forgotten. Evidently the larder was used as a dining-room and occasionally as a bed-chamber, for there was no real stock of food.

I believe that every stoat which has an established hunting range has several such caches, to which it drags food when in the mood; but a nomadic stoat eats where it kills and sleeps when fed. Thus this animal has been found asleep in the nesting-box of the hen-house he had recently invaded, surrounded on every side by the evidence of his crime.

**Voice.**—Probably very few observers have heard the “bark” of a stoat, but it is a sound which, once heard, is not forgotten. One night I took one of these animals in a box-trap set in the garden at no great distance from my bedroom window, and during the night the stoat, while attempting to escape from the wire portion of the trap, was struck at by an owl. Thus I was wakened by a veritable pandemonium. Inside the trap, the stoat was barking repeatedly, while on a post near by the owl hooted and screeched. Clearly deadly foes had met, and each was much enraged.

The bark is almost identical to the sound caused by beating two flints together, and it is sufficiently powerful to carry two or three hundred yards. In this case the stoat kept it up for thirty minutes or more after the owl had left, and so haunting and malicious was the sound that it rang in my ears for some time.

**Ferocity.**—Stoats will attack practically anything they can catch and hold, and within my experience a pack of them attacked a lesser black-backed gull, which is certainly a formidable bird. The gull was roosting on a mound in the centre of a peat hag, and many other gulls occupied the swamp. The big gull was seen to rise, struggling desperately to obtain command of the air. Flapping and screaming it made its way across the swamp, where it fell into the rushes, and when the observer got to the place he found the bird almost dead, and saw several stoats run off through the rushes. This occurred in the West Riding.

Other cases are on record of stoats having been attacked by hawks, resulting in the death of both of them, or at any rate of the hawk.

**Musk Glands.**—In all the weasels, excepting the marten, the musk glands are highly developed. In the case of the badger, the secretion is not so nauseous as in the other weasels, nor is it used for the same purposes. It has, indeed, been said that the glands are provided in the case of the badger as a subsidiary means of tiding over the foodless months, but if this be so, their use is unique.

The value of musk glands, it is generally admitted, is to afford a means of bringing the sexes together, and doubtless they are there for this purpose in the case of the weasels. So highly developed are they in certain instances, however, that Nature seems to have run riot with her original scheme. Thus the skunk possesses the power of ejecting the musk in a fine choking spray which no beast will face, and there can be little doubt that stoats, weasels and polecats also possess this power to a much less degree. With them it merely amounts to being able to control the amount of scent they give.

Do stoats and weasels use their musk scent in their hunting?

The available evidence would seem to prove that they do. It is known that a hare will run for miles from a marten, which is a practically scentless member of the weasel family, but how far will a hare or a rabbit run from a stoat? Not more than a mile or so at the most, for once that deadly taint reaches him he becomes paralysed with terror.

One day when motoring from Peebles to Edinburgh and when near to Leadburn I saw a rabbit cross the road and take shelter in some whins, while its manner of progress clearly indicated that it was being run by a weasel. I stopped the car to watch proceedings, and five minutes later a stoat appeared, running the trail of the rabbit. He saw the car and its occupants, and hesitated in crossing the road. With characteristic curiosity he came up towards us to investigate, and on his reaching a certain point the wind bore in a direct line from him to the rabbit, and at that precise moment a pitiful squealing was heard from the whins. This seemed to excite the stoat, and returning to his original line he crossed the road and went straight over to the gorse bush, whereupon the squealing ceased. Going up, I found the dead rabbit. In this case, as in others which could be recorded, the quarry gave up immediately it obtained the deadly musk scent of its pursuer.

For all their extraordinary abilities, stoats, like most beasts which are short in the leg and whose horizon, therefore, is limited, are possessed of very poor eyesight. They fear the





FIG. 1.— Stoat taking up a Bait.





scent of man greatly, but if they cannot scent him and can merely see him, they will watch curiously till within a few feet. This is a point to bear in mind when the stoat is seen at a distance, for by making use of the wind one can generally approach sufficiently closely for shot and powder to be effective.

**Hunting in Trees.**—Stoats are first-rate climbers, and where there are plenty of small birds and wood pigeons they habitually hunt ivy-covered trees. In Northamptonshire a partially devoured wood pigeon was found in an ivy tree, and a trap was set alongside it to discover the culprit. Next morning the trap was on the ground with a stoat fast in it.

**Natural Enemies.**—The stoat has no particular animal foes. Very few dogs, even, unless hardened hunters, will face this nauseous little musk bearer. More stoats are killed by stoats than by all the keeper's devices, and were this not so, game preservation would become difficult in many localities.

When stoat meets stoat it is either as mate or as deadly foe. In nine cases out of ten it is the latter. One turns and flees, and unless he or she makes good its escape, a fight to a finish is certain. They are the most deadly cannibals I know, and no bait is so irresistible to a stoat or a weasel as a member of its own race. Time and again I have known such a bait to produce results when all else had failed.

**Trapping.**—This brings us to the subject of trapping these bloodthirsty little beasts. In using steel traps a bait is not generally employed, as it attracts other creatures which will spring the trap and consume the bait.

Every keeper should have by him one or two good box-traps, and the accompanying sketches show the devices which the writer has found most convenient and effective. While at it, a thoroughly good article should be made, as shoddy workmanship only leads to unreliability, whereas a well-made box-trap will last a lifetime.

Fig. 2 is a double-ended trap, and is useful during the running season, as when one stoat is caught a second is almost sure to go to it and will thus be found in the adjoining compartment. Fig. 3 shows the best all-round trap for general use. As will be seen it consists of a tunnel, having a trap door at either end. On the spring plate being depressed, the doors close simultaneously, for it will be seen that any pressure applied to the spring-plate tends to move the crank controlling the doors over the dead centre position, in which it is poised when the trap is set. The bait is suspended from the lid of the

trap directly above the spring-plate, and the stoat, endeavouring to tear it down, is bound to spring the device. One of these

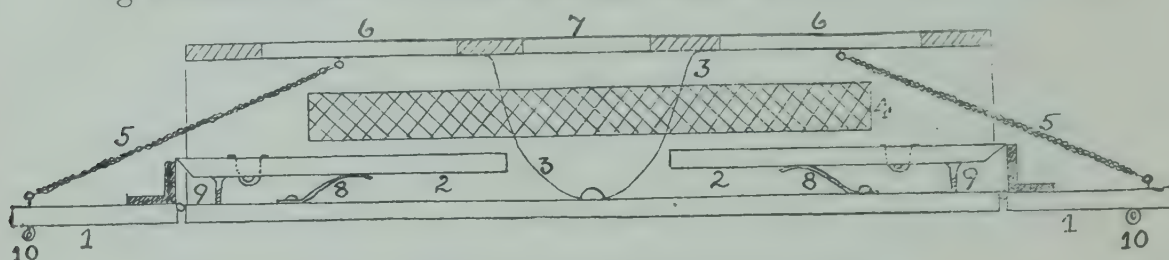
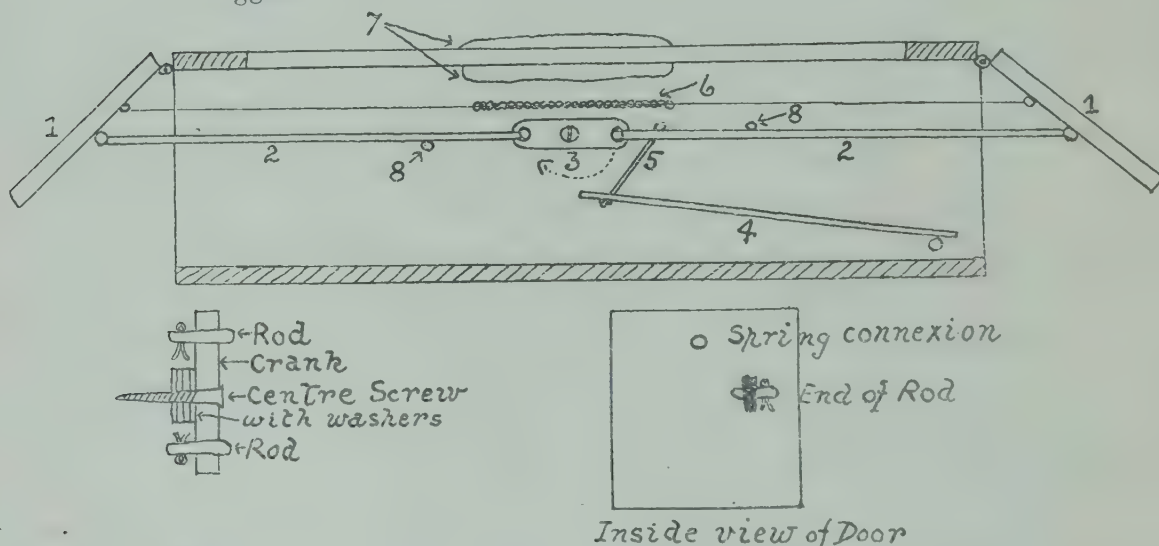


Fig. 2.—Double Ended Trap (Longitudinal Section).

1. Trap Doors.
2. Spring Plates.
3. Wire Netting Tray in which Bait rests.
4. Wire Netting Windows (both sides).
5. Door Springs.
6. Lids to separate ends.
7. Lid for renewing Bait without disturbing trap.
8. Light Clock Springs to return Spring Plates.
9. Screws fixed in floor to serve as stops for Spring Plates.
10. Leather Tags for opening doors. To set Trap the doors are simply opened, whereupon the spring plates automatically engage with the triggers.



Inside view of Door

Fig. 3.—“Straight through” Box Trap (Longitudinal Section).

1. Trap Doors.
2. Thick Wire Rods which actuate doors.
3. Crank, free to rotate on its centre screw. As shown it is at dead centre, and both doors are propped open. As the crank turns in direction of arrow both doors close.
4. Spring Plate.
5. Cord connection between spring plate and crank.
6. Door Spring.
7. Strong Spring in lid for bait and handle.
8. Stops.

should be set along a wall bottom with iron traps on either side of it.

**Mating.**—Running begins in February, and the young, five or six in number, are born for the most part early in April. By the middle of that month the keeper should keep a close look-out for them, as even before their eyes are open the mother will often bring them out to bask in the sun. A little later they play about the den mouth, quite fearless of man, but if



disturbed the dam will remove her litter quickly as a vixen, and they are then lost for all time. Thus, when following the dykes or woodland banks at this season, the keeper, or whoever it be, needs to keep very keenly alive, and to move as quietly as possible.

Stoats will breed anywhere that adequate shelter exists. I have known them to breed in stone walls, in ruined buildings, in upturned tree roots, and in rat burrows about the hedge bottoms. Generally the nest is built of leaves, and sometimes of grass. When running, stoats follow stone walls for preference, showing a special partiality to certain walls which become known to the keeper as time passes. The animals are still comparatively rare in my own locality, but there is one ancient wall which runs for miles across country where they can be trapped with some regularity.

**Colour Change and Value of Tail.**—The *sine quâ non* of the stoat is, of course, his black tipped tail, which follows him everywhere like an angry hornet. Almost as often as not the black tip is what catches the eye.

The tail of the stoat bears evidence to an ancestry more arboreal in habits than were the ancestors of the weasel and the otter. Evidently this animal springs from the same line as the martens, and its comparatively bushy tail has its distinct uses. The tail of the squirrel is his rudder, his parachute. It assists his leap, it breaks his fall, it enables him to land head upwards on the vertical trunk. So anyone who has seen stoats hunting each other will have observed the important part the tail plays. Bushed out like a bottle brush, it is whirled this way and that with every lightning double and twist, and it is suggested that a wild stoat deprived of its tail would not long be able to exist. It would disappear, just as certainly as does the squirrel on which such a mishap falls.

Stoats begin to assume their winter coat in November, and the change back occurs during February and March. A great deal depends upon the altitude and the climate of the range they haunt. Those which inhabit high country are usually quite white by December, and may remain so till the middle of March, whereas a stoat living in the low country may merely become camouflaged with white, as though with pardonable uncertainty as to what the weather gods will send.

Indeed the colour change of the stoat presents one of the curiosities of nature, and at the time of writing zoologists are at work in the hope of throwing new light on the subject.

## THE IMPORTANCE AND VALUE OF POULTRY FEATHERS.

*Communicated by the Rural Industries Intelligence Bureau.*

POULTRY keeping, at one time little more than a sideline of merely secondary importance to the majority of those undertaking it, has of late years developed into a highly organised and scientifically conducted rural industry, on which an increasing number of people tend to rely for a partial, indeed, in many cases, for a principal means of support. A particular feature since the War has been the large number of ex-Service men who have taken it up for a living, in most cases on a small scale.

There is no intention in these brief notes of dealing in any way with the technicalities of poultry husbandry. This subject is outside the scope of the Bureau's activities, and is amply catered for by many competent and valuable organisations, periodicals and text books. Nevertheless, poultry keeping is not so remunerative that those engaged in it can afford to neglect possibilities, however small, of adding to its earning capacity, and this is especially true when the occupation is carried on in a comparatively small way.

Various indications suggest that quite a considerable proportion of poultry keepers overlook the fact that the feathers of their birds are a marketable commodity, and though business practice may often entail sending away living or unplucked birds, feathers which might be collected and disposed of are, in a very large number of cases, treated as valueless rubbish.

**Imports.**—The following figures will give some idea of the quantities of feathers that are annually imported into the United Kingdom from abroad:—

	1913.		1920.		1922.	
	Cwt.	Value.	Cwt.	Value.	Cwt.	Value.
		£		£		£
France ...	3,778	11,108	2,239	21,100	3,260	12,250
Germany ..	3,553	35,715	507	14,975	435	1,577
Netherlands ...	45	297	4,989	28,308	86	586
Denmark ...	—	—	—	—	4,491	34,479
China ...	9,989	33,923	27,367	223,692	18,292	79,576
Hongkong ...	18,616	55,669	36,551	245,309	21,467	87,841
Japan ...	3,330	3,867	37	329	636	1,349
U.S.A. ...	3,329	6,515	5,311	22,077	12,825	21,264
Other countries	2,376	12,272	2,114	31,726	4,612	29,543
TOTALS ...	45,016	£159,366	79,115	£587,516	66,104	£268,765



For purposes of comparison the following totals for intermediate years are added :—

1919—52,468 cwt. valued at £284,791.

1921—27,894 cwt. „ „ £146,644.

It will be evident that after a heavy drop in 1921 from the high figures and prices of 1920 the demand for this commodity is again very decidedly on the increase.

Besides imports from foreign countries into Great Britain, considerable supplies come from Ireland to Great Britain, as the following figures will show :—

1918—20,324 cwt. valued at £42,680.

1920—15,557 cwt. „ „ £72,599.

All the above figures relate to imports of the cheaper sorts of feathers (described as “ in or for beds ”), *i.e.*, poultry and the like, and do not include the rarer and more valuable kinds such as are used for expensive millinery and other ornamental purposes.

It is hoped by these extracts from official sources to bring prominently to the notice of those interested in poultry keeping in this country, the fact that poultry feathers are the raw material of quite a considerable industry, for which by far the greater proportion of the present supplies is now obtained abroad. There can be no doubt therefore that the collection of these feathers is well worth the attention of the poultry keeper at home.

**Grading.**—Poultry feathers should be graded as follows :—

1. Down feathers; 2. Soft feathers; and 3. Stiff wing and tail feathers, usually referred to generally as quill feathers. In addition, white feathers, which are more valuable, should be kept separate from coloured ones.

**Uses.**—Down feathers are used chiefly for stuffing mattresses, pillows, cushions, etc. Soft feathers are also in many cases used for similar purposes, but they have a further use in the millinery trade, and by no means only for the least expensive class of goods. White feathers command the highest price for these purposes. It is generally considered that imported feathers are better than English ones, and they have in the past realised better prices, but the main reason for this preference appears to be that they are more carefully graded and prepared to suit the feather merchant's requirements.

Quill feathers are of less value and use now-a-days than either of the other kinds. Not all dealers will accept them, but they are nevertheless used for a number of purposes, amongst which may be mentioned the manufacture of feather dusters and certain other articles in the fancy goods and artificial flower trades,

whilst the smaller sizes are also sold in small bundles as pipe cleaners. One or two merchants exist as dealers in quill feathers exclusively.

**Preparation of Feathers for Disposal.**—The price to be obtained will greatly depend on the care taken of the feathers by the collector. If possible, the feathers should be graded when plucked, both as regards colour and quality. Quills should always be kept separate and fowl feathers should be kept separate from those of ducks or geese, as these are of much greater value. It is important that all feathers to be sold should be as clean as possible and quite dry. As previously mentioned an important reason for the buyer's preference for foreign feathers is that these particulars are more carefully attended to.

In the case of feathers which it is intended to dispose of to feather merchants it is not necessary to take any steps to "cure" them, in fact merchants as a rule prefer that the feathers should not be previously treated, as they have special machinery for this purpose. Should it be desired, however, to use the feathers at home for making cushions, etc., the following process is sometimes used:—

To clean the feathers from their animal oil they should be steeped in lime water made in the proportion of one lb. of lime to each gallon of water. The lime residue should be removed from the lime water before steeping the feathers. The feathers should be well stirred into the lime water and then allowed to remain in it for some hours, after which the lime water should be poured off and the feathers thoroughly rinsed in cold running water.

To clean the feathers from dirt only, wash them with soap in hot water and rinse with warm water afterwards. After rinsing they should be well drained either in a sieve or on a wire frame, and well shaken about while still warm, after which a moderate amount of further artificial warming will dry them completely. They should be kept loosely packed in muslin bags, hung up in a dry loft, so that air can circulate round and keep them as far as possible from any chance of getting damp, until sufficient have been collected. If they have to be retained thus for any length of time, they should be examined now and then to see that they are free from moth.

The methods outlined above are to be regarded more as preservative than as adequate purification, and feathers so treated would still have to go through a more thorough and scientific process in the factory before being fit for industrial purposes.



**Prices.**—Prices depend very much upon quality and condition, and also to some extent upon the quantities offered. Better prices will be obtained by dealing direct with firms of feather purifiers than by selling them to travelling collectors or middlemen.

While most of these firms do not care to take small lots, and stipulate for quantities of not less than one or two hundredweight at a time, there are some who will buy small parcels, provided the contents are sorted, graded, clean and dry. Carriage, however, may generally have to be paid by the sender on lots under 2 cwt. or so. It is understood that the prices at present obtainable are approximately as follows:—

Fowl feathers, picked clear of wing and tail quills—

Coloured—3½d. to 5½d. per lb.

White—5½d. to 6½d. per lb.

English Duck feathers, picked clear of wing and tail quills—

Grey—1s. 2d. to 1s. 8d. per lb.

White—1s. 8d. to 2s. 3d. per lb.

English Goose feathers, picked clear of wing and tail quills—

Grey—1s. 6d. to 1s. 9d. per lb.

White—1s. 10d. to 2s. 6d. per lb.

Duck and Goose quills—3d. to 3½d. per lb.

For fowl quills there is only a limited market at 1½d. to 2d. per lb.

Turkey body feathers vary considerably, both as regards demand and price, the latter at present being between 4d. and 7d. per lb.

Turkey quills 2½d. to 3d. per lb.

**Methods of Disposal.**—The Ministry of Agriculture will, on request, send to any poultry keeper having feathers to dispose of a list of dealers in feathers. Applications should be addressed to The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1. The Bureau is also prepared to assist applicants as far as possible in a similar way.

Copies of this article, in the form of a leaflet, and additional information on matters arising out of it, can be obtained on application to The Secretary, Rural Industries Intelligence Bureau, 258/262, Westminster Bridge Road, London, S.E.1.

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## HORTICULTURE IN THE ISLES OF SCILLY.

B. L. WOLF and A. D. R. WALBANK.

*Ministry of Agriculture and Fisheries.*

FIFTY years ago commercial flower growing was unknown in the Isles of Scilly. Farming and fishing were the normal occupations of the islanders. With regard to the former, the stock consisted of milch cows, sheep and pigs, with the minimum complement of horses needed for the somewhat restricted farming operations carried out. The soil was too light for wheat,

a certain amount of oats was grown, but the main crop relied upon was barley, utilised for bread-making for home consumption. Late potatoes were produced and those surplus to domestic requirements were exported to France and Portugal. Early sorts were not cultivated in those lean farming days when the inhabitants of the islands lived a hand-to-mouth existence and the potentialities of the soil and climatic conditions had not been discovered. It is probable that fishing was more extensively engaged in then than at the present time. The bulk of the fish was marketed in Brest.

**The Birth of the Flower Industry.**—Forty-three years have elapsed since the first steps were taken towards the establishment of the flower industry, and it is highly improbable that its pioneers foresaw that it would reach its present dimensions. A few Soliel d'or, Scilly White, and possibly some Double White Narcissi, growing in the islands, and till then practically ignored, were planted out and cultivated for the production of blooms for market. It is believed that these were disposed of in Penzance, and good prices were realised for the magnificent flowers produced. This humble beginning in the cultivation of a few narcissi opened up the prospect of a way out of the poverty which the islanders had for so long endured. The next step seems to have been the introduction of *Ornatus* from the districts around Paris. Then came *Princeps*, *Obvallaris*, *Henry Irving*, and, in due course, other varieties which are still known and welcomed in the English markets. Little by little the advantages of the equable climate and warm soils were disclosed, until to-day flower growing is the staple industry—in fact, it would appear, that upon the continued success of this industry depends the future prosperity of the Scillies. Doubtless there are side-lines which may come in very usefully, such as early potatoes, which have been profitably exploited, asparagus and other items yet to be determined, but it is difficult to predict any crop that will displace the cultivation of flowers as the main source of revenue. Assuredly, plants other than bulbs will play their part in a well conceived rotation, but always as a preparatory crop for the betterment of the soil conditions in view of the production of flowers for the early markets.

**The Present Difficulties of the Flower Industry.**—During the past few years increasing difficulty has been experienced in procuring good crops of flowers. Recent investigations made in the islands point to the probability of a number of factors contributing to the conditions responsible for the declining yield. Some of the soil is undoubtedly sour and unbalanced, owing to



the indiscriminate use of artificial fertilisers, the inadequate use of lime, and constant cropping with narcissi. Eelworms have been found to attack bulbs; bacteria and fungi are also present. It is not to be inferred that the islands are full of disease and that the flower industry is on the verge of disaster. Far from it! But the state of the soil and the introduction of the pathogenic organisms referred to above are sufficient to arouse apprehension as to the future. The inhabitants of the Scillies have initiated and built up an industry, and the same persistency and determination to succeed that have characterised them in their years of effort, are evidencing themselves now in order that the hard-won position may be consolidated and maintained. The combination of circumstances that has arisen to hinder them in their march to prosperity has no doubt influenced them in their decision to avail themselves of the opportunity of setting up a system of Horticultural Education which has presented itself through the action of the Duchy of Cornwall and the Ministry of Agriculture.

**System of Horticultural Education.**—The Council of the Isles of Scilly is responsible for education in the islands. There are five schools, one on each of the inhabited isles. The schools are maintained out of local rates, a grant in aid of approved expenditure being paid by the Board of Education as in the case of such expenditure incurred by Local Authorities on the mainland. The Council has now transferred its powers with regard to agricultural education to the Agricultural Committee, and a grant in aid of approved expenditure under this head will be paid by the Ministry. The Duchy of Cornwall is making a special contribution to the rates for the purpose of the scheme.

The Agricultural Committee has appointed an advisory research worker, who will reside on the Island of St. Mary's, and act as technical adviser to the Committee. He will also give lectures and pay advisory visits to growers on each of the islands.

**Proposed Experimental Station.**—Some ten acres of land have been put at the disposal of the Committee, by the Duchy of Cornwall, for the purpose of establishing an experimental station. All problems relating to bulbs will be dealt with here. Manurial and variety trials for bulbs and early potatoes will be undertaken, and new sorts tested. Other crops likely to prove useful in balancing the rotation and for early market work will be grown. This new departure will be watched with interest. It is the only experimental station specially interested in bulbs in Great Britain, and possibly in the world.

**The Control of Plant Diseases.**—Another innovation in the islands is the erection of a bulb sterilising plant. The Duchy of Cornwall has had this plant installed for the use of growers and it will be run, as far as possible, on a self-supporting basis. Those wishing to have their bulbs sterilised will be able to do so upon payment of a small fee, thus relieving them of the necessity of making a capital outlay for the purchase of their own sterilising plant. The proposal is to have an experienced man in charge of the plant, who will also be attached to the experimental station and be able to fill in his spare time at the farm.

By request of the growers, the Ministry has issued an Order, entitled “Bulb Diseases (Isles of Scilly) Order, 1923,” which came into operation on 1st January, 1924. The provisions of the Order are designed, *inter alia* (a) to impose restrictions on the importation into the islands of daffodil and narcissus bulbs; (b) to procure the destruction or treatment of diseased bulbs which may be present within the islands.

**The Future of the Flower Industry.**—The islanders are to be congratulated on the enterprising methods which they are entertaining for the preservation and development of their industry. They are gradually adopting more modern ways of packing and marketing their produce.

They have two Growers' Associations, one on St. Mary's and one on Tresco, which witness to their belief in co-operation. It is to be hoped that co-operative methods will be developed and the logical conclusion reached in the amalgamation of the associations now in being. In the recognition of such potent factors as co-operation and education in the development of an industry, their business acumen is disclosed. When the application of the results of scientific research displaces where necessary old practices based upon past precepts, there should be no misgivings regarding the prosperity of the flower industry of the Isles of Scilly.

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## WOODLICE IN GLASSHOUSES.

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THE woodlice inhabiting glasshouses are limited to a few species, some of which, however, occur in enormous numbers.

As one would expect, some are found commonly in the neighbourhood of glasshouses, and enter during the winter months



to obtain shelter. Others seem especially adapted to life at high temperatures such as obtain in cucumber houses during the summer, and seldom, if ever, occur far from the houses, though they are capable of withstanding severe frosts outside, provided that they can bury themselves to some depth in heaps of soil. The general food of woodlice consists of decaying or fermenting cellulose, but they will, under certain circumstances, gnaw the stems and roots of healthy plants, and some even climb to eat pear-shaped holes in the leaves.

Certain species of the genus *Armadillidium* cause very serious damage to growing plants. *Armadillidium speyeri*, Jackson, and *A. pictum*, Br., are practically confined to cucumber houses, the former being exceptionally abundant and voracious. *A. vulgare*, Latr., the common pill woodlouse, is found more often in the cooler tomato houses, is very numerous in peach houses, and is also found in the nests of ants. All these roll up into a ball when disturbed, a complete sphere being formed by the broad and bulky *A. vulgare*, while in the other two more slender and active species the tail appendages overlap the head. Two other species are common in tomato houses, namely, *Porcellio laevis*, Latr. and *Haplophthalmus danicus*, B. Lund, but they do little damage to the plants.

The breeding season for these woodlice occurs from early spring to August. The young escape from a specially developed pouch on the underside of the thorax in which the eggs develop.

**Winter Habits.**—On the approach of winter, *A. vulgare* buries itself to a great depth in the ground and there remains inactive. The species found in cucumber houses, however, remain more or less active, unless they are taken outside when the borders are cleared from the houses. In the latter event they will remain buried until spring, when they become active and readily regain access to the houses.

**Damage to Plants.**—The species of *Armadillidium* are brought into propagating houses in great numbers from heaps of soil which have been stacked outside during the winter. When the seedlings appear in the boxes, the hungry woodlice at once find a suitable supply of food. *A. speyeri* causes most loss by biting through the stems of tomato seedlings near the soil level, and *A. vulgare* is also responsible for similar damage, though to a less extent. At this time, the cucumber seedling is not so liable to attack. When the plants are potted out *A. vulgare* ceases its activities, but *A. speyeri* turns its attention to them.

Pear-shaped holes are eaten in the lower leaves, the cotyledons often being entirely destroyed, and in severe cases a considerable portion of the leaf-surface is removed. Such damage is continued throughout the growing season upon plants in the border unless control measures are employed.

Late in the season, *A. speyeri* has been observed to do considerable damage by eating the petals of carnation flowers. *A. vulgare*, on the other hand, is much less harmful and usually leaves tomato houses in May or June. As the cucumber borders are top dressed throughout the growing season from heaps of soil and manure outside, the number of woodlice increases to an enormous extent as the season advances. *A. vulgare* is particularly addicted to removing the bark from branches of peach-trees. Both species feed mostly at night.

**Control Measures.**—In glasshouses, control measures may be divided into two categories:—(1) Destruction of woodlice in the winter; (2) Trapping in summer.

(1) **Destruction of Woodlice in the Winter.**—At the end of the season when the border soil is removed from the cucumber houses, great numbers of woodlice are taken away at the same time. Those that remain may be destroyed by hot water or cresylic acid.

(a) *Hot Water Treatment.*—Where apparatus is available for the distribution of water at a high temperature in glasshouses, the treatment is undoubtedly the most radical in the control of woodlice. To determine the effect of temperature on these woodlice, a thermostatic bath was employed. In this was placed a vessel containing soil into which the woodlice could be introduced. With the water in the thermostat at 147° F., the soil at an internal temperature of 146° F., and with a surface temperature of 124° F., all woodlice introduced on the soil surface were killed in 30 seconds.

With the thermostat temperature at 140° F., the soil internally at 136° F., and the soil surface at 108° F., woodlice similarly introduced were killed within two minutes. Woodlice dipped for half a second in water at 149° F., died within a few minutes after immersion. These experiments show that the *Armadillidium* is easily killed by water at comparatively low temperatures and accounts for the efficiency of the hot-water treatment.

(b) *Cresylic Acid Treatment.*—If the necessary apparatus for hot-water treatment is not available, the woodlice may be





FIG. 1.—The Pill Woodlouse (*Armadillidium vulgare*, Latreille) enlarged: (*left*) male; (*right*) female. Note the absence of the rostrum on the head, and the thick rounded appearance of the animal.



FIG. 2.—The Cucumber-house Woodlouse (*A. s. eyeri*, Jackson) enlarged: (*left*) male; (*right*) female. Note the shape of the tail appendages and the very prominent rostrum on the head.

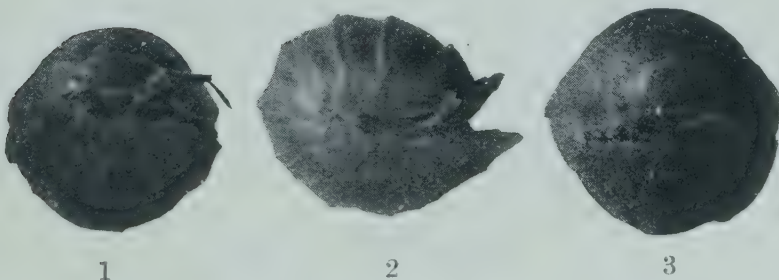


FIG. 3.—(1) *A. speyeri*, Jackson. Anterior view of animal rolled up.  
 (2) *A. speyeri*, Jackson. Side view.  
 (3) *A. vulgare*, Latreille. Anterior view of the animal almost rolled up.

Note the straight line formed by the edge of the posterior segments in No. 3, and the projection of the abdomen beyond the head in No. 2.

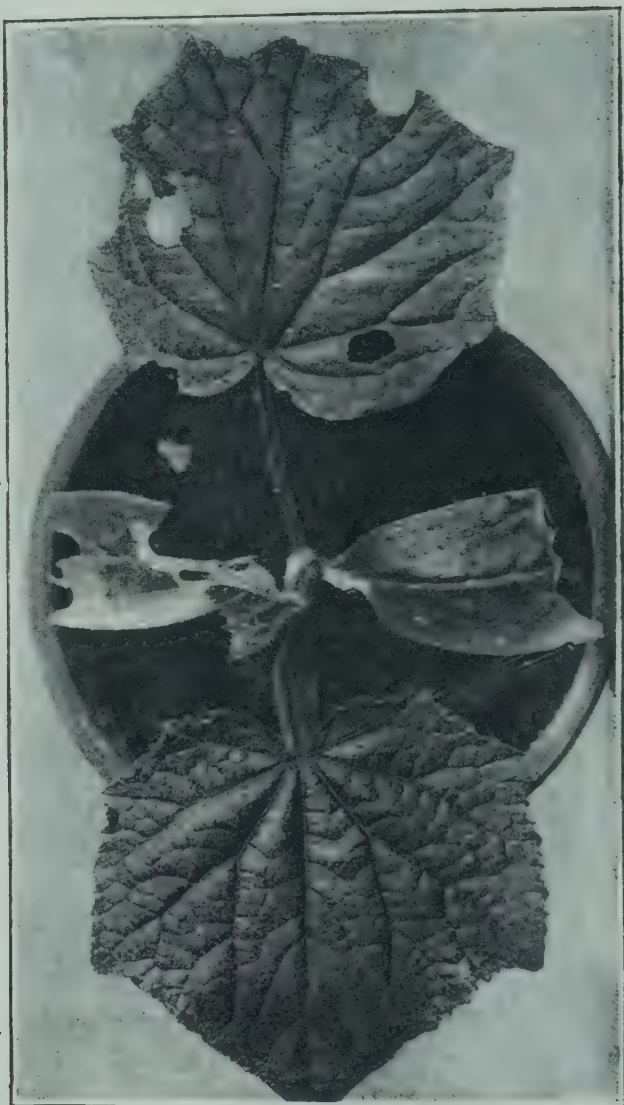


FIG. 5. Showing damage to Cucumber pot-plant caused by *Armadillidium speyeri*, Jackson.

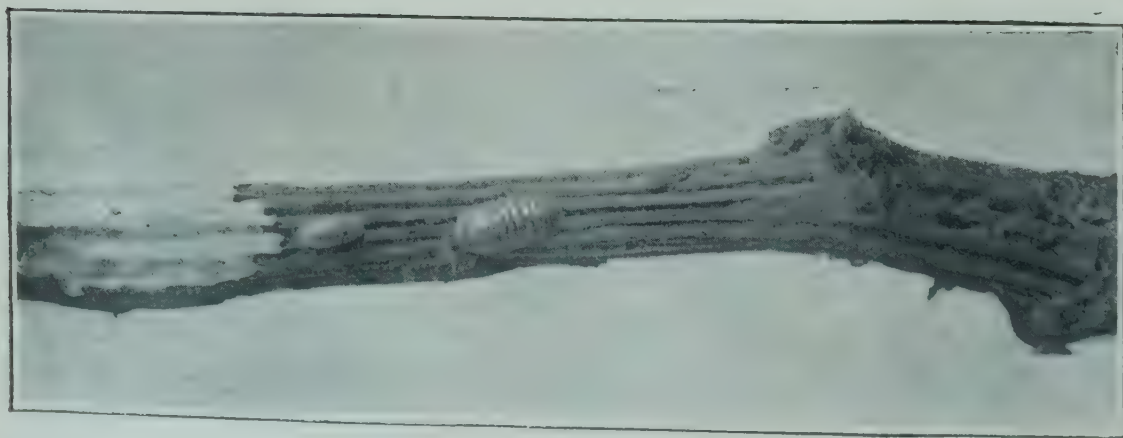


FIG. 4.—*Armadillidium speyeri*, Jackson, damaging Cucumber stem.



destroyed by spraying thoroughly the soil, walls, and woodwork with the following mixture :—

Cresylic acid (pale straw 97–99 per cent.)	...	1 gallon.
Potash soft soap (household)	... ..	8 lb.
Pure naphthalene	... ..	$\frac{1}{2}$ lb.

These are heated together in a bucket till the soap is melted and the naphthalene dissolved. For spraying, 2 pints of the mixture are used to every 12 gallons of water.

The following experiment serves to illustrate the effectiveness of this treatment. A cucumber house 15 ft.  $\times$  12 $\frac{1}{2}$  ft. (1,000 cubic feet space) was treated exactly as described above in November, 1922. Two days after spraying a collection was made from one side of the house only, and the following figures show the relative proportions of living and dead woodlice :—

		Dead.	Living.
<i>Armadillidium speyeri</i>	... ..	481	5
<i>Armadillidium vulgare</i>	... ..	98	1
<i>Metapornothus pruinus</i>	... ..	1	6
		—	—
Total	... ..	580	12
		—	—

This represents a mortality of just under 99 per cent.; the efficiency of the mixture is due in part to the cresylic acid and in part to the naphthalene.

**2. Trapping in Summer.**—It has been remarked that these woodlice feed for the most part upon decaying cellulose, and that they obtain an ideal supply of food in the cucumber borders. This makes it a matter of great difficulty to attract them with any substance used commonly in baits. As an attracting basis coarsely ground oatmeal has been found more useful than bran, flour, or starch: it becomes specially attractive to the woodlice when mixed with glucose or treacle. Laevulose, saccharose, mannite and glucose were tested: the last appeared to be most attractive. In our experiments, which were carried out with several arsenical compounds, we have stained the poisoned oatmeal with cochineal, and after several days have dissected the woodlice to make sure that they have eaten the bait, the red cochineal being readily detected in the stomach of the woodlouse. In not a single case has a woodlouse died from eating these poisons, although in all cases the bait has been found in the intestines of the animal when dissected.

After a number of unsuccessful trials with compounds containing copper, it was found that substances containing chromium had the desired effect, the soluble bichromates being the most

satisfactory. Of the latter, potassium bichromate when used in a solution above  $2\frac{1}{2}$  per cent. strength caused death in every case. Solutions containing but a trace of potassium bichromate when injected into the bodies of woodlice have produced almost instant death.

A bait consisting of oatmeal 10 parts, glucose 2 parts, potassium bichromate 1 part, and water 10 parts, costing about 3d. per lb., which acted consistently on woodlice kept in jars and dishes, was only successful to a slight degree when used on cucumber borders, owing to the difficulty of attracting the animals from their natural food. It still remains, however, to give this bait a trial in the propagating houses, where it will be more useful, being distributed at times when the woodlice are short of food.

*Pot-trapping.*—The use of inverted flower-pots filled with straw has long been in vogue for catching woodlice. The following tables show the numbers caught with various materials in the pots :—

*November, 1921. Average number caught in one pot per night on cucumber house subsoil.*

<i>Substance.</i>	<i>Average number caught in one pot over four days.</i>
Common straw treated with boiling water ...	43
Border straw + dung, untreated ...	74
Ditto, treated with boiling water ...	104
Fermented straw ...	154
Common straw treated with boiling water + molasses	272

*August, 1922. Actual numbers caught in one pot per night on cucumber border with growing plants.*

<i>Substance.</i>	<i>Numbers caught in one pot.</i>				
	1st day.	2nd day.	3rd day.	7th day.	Total.
Common straw, untreated	2	2	0	3	7
Common straw, untreated + 5 per cent. glucose	5	7	2	8	22
Fermented straw ...	3	15	30	43	91
Fermented straw + boiling water ...	0	4	0	0	4
<i>On another border :</i>					
Fermented straw ...	200	170	122	50	545
Fermented straw + 5 per cent. pot. bichromate ...	38	100	14	8	160
Fermented straw + 10 per cent. pot. bichromate ...	0	2	0	0	2
Fermented straw + 10 per cent. calcium bichromate	2	0	0	5	7
Common straw, untreated	530	32	0	14	576
Common straw + 10 per cent. glucose ...	2,500	200	12	0	2,712



These figures show that fermented straw is more attractive than unfermented, and that the addition of glucose to common straw increases its attractive qualities; that addition of potassium or calcium bichromate makes the straw distasteful; and that the attractive ingredients in fermented straw are soluble in water and can be extracted.

Further, it is seen that in a given area the number of woodlice decreases with consistent pot-trapping. Any method of this kind is, however, laborious on a large scale, and is only successful over limited areas.

*Vegetable Baits.*—By far the best control, both in cucumber and tomato houses, is attained by the use of red beets or mangolds. These are cut in halves and placed face downwards on the soil, one half to every four plants. The woodlice collect in large numbers on the vegetables, and are shaken every morning into a pail of hot water. All the woodlice cannot be destroyed by this method, but they are kept from feeding on the plants. Red beets are preferable to mangolds as they decay less rapidly, the former lasting from six weeks to two months.

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## DESTRUCTION OF WIREWORMS.

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THE following figures are the result of a study of the numbers of wireworms in arable land made during the years 1914 to 1922 inclusive. Most of the figures refer to land ploughed up from pasture, and show the gradual reduction under cultivation of the huge numbers in the original pasture. No special treatment was given in any of the fields and no insecticidal dressing was added.

The method adopted in obtaining the figures was to dig out portions of soil in different parts of the various fields, carefully crumble and sift the samples, and count the wireworms in them. The size of the test samples of soil was at first one foot cube, but later blocks 9 in. square on the surface and 1 ft. in depth were used.

The number of test samples in a field varied from five to twelve, and in subsequent counts on the same field the same number of samples was taken. The average number of wire-

worms found in the samples from a field was then multiplied to obtain an estimate of the number per acre.

**Permanent Grass Fields.**—Samples were taken from eight pastures, varying in size from  $3\frac{1}{2}$  to 14 acres and in soil from light loam to heavy loam. The estimated number of wireworms per acre in the different fields was found to vary from 103,000 to 900,000, the average being 305,000. In four arable fields which had been over five years under cultivation the number varied from 44,000 per acre to 95,000 per acre, the average being 81,000.

It will be seen that the wireworms were approximately four times as numerous in the grass land as in the arable land. In general they were more abundant in the lighter soils.

**Depth Distribution and Local Movement of Wireworms in the Soil.**—Although no attempt was made to count the numbers at different depths the following observations were made. On grass land the wireworms were near the surface, the great bulk being in the mat of roots in the top inch of soil. Relatively few were below 3 in. and they were rarely found lower than 6 in.

There was no evidence of a downward movement during cold weather. The observations were made during the worst months of the year, and several times counts were made immediately after very severe frosts. On one occasion during 18 degrees (F.) of frost lumps were chopped out of the surface. The wireworms were embedded tightly in the frozen mass and were alive and unaffected after the subsequent thaw.

On arable land the wireworms appeared to avoid the dry loose surface and were found to be most numerous at 3 or 4 in. depth: they were frequently about 6 in. deep but very rarely below 9 in.

The crop grown on a field, however, exerts a considerable influence on their local movements. With cereals and "seeds" they remain fairly evenly distributed, but with more widely drilled crops they collect in quantity along the rows and are often closely massed together. White turnips appeared to collect them most, and from small root systems 30 wireworms were often gathered. Swedes, cabbages, kale, potatoes and mangolds were also good collectors, but not so good as turnips. Beans and peas did not appear to influence them much unless the beans were dibbled and the peas drilled thinly with wide intervals between the drills.



This local movement and its apparent variation with different crops appeared to be connected with :—

- (a) Preference or otherwise for the crop as food ;
- (b) Relative spreading of the root systems of the plants, especially when these are young ;
- (c) The difference of cultural treatment, especially the more or less complete removal of weeds between the drills and the disturbance of the soil.

Migration *en bloc* from one portion of the field to another never took place. For example, turnips; oats and linseed in one field did not affect the average distribution. Frequently damage showed on one crop and not on another, but the general distribution was not altered, for example, potatoes showed damage on one half of a field and oats on the other apparently did not suffer. Oats suffered in another case whereas peas on the same field did not. Beans were apparently unaffected in another field while kales were taken.

**Reduction under Cultivation.**—The following table shows the reduction in the estimated numbers when grass land was ploughed up and kept under cultivation for a number of years :—

Field Q was ploughed up in 1914 (Autumn), and fields T, M, and 10 were ploughed up in 1918 (Spring). Field 3 was old arable land.

Field.	Estimated number of Wireworms per acre.								
	1914	1915	1916	1917	1918	1919	1920	1921	1922
Q		900,000	850,000	680,000	440,000	283,500	32,700	21,800	6,000
T	—	—	—	—	510,000	435,600	331,700	148,000	18,000
M	—	—	—	—	350,000	228,700	94,000	50,000	15,000
10	—	—	—	—	215,000	92,600	26,800	30,000	43,600
3	218,000	—	50,000	—	43,600	—	116,160	—	49,100

It will be seen that there was a continuous and rapid fall in the wireworm content, especially after the first year under cultivation.

From a study of the cropping of these fields the number 200,000 per acre may be considered the utmost limit for safety as regards damage to crops. From 100,000 to 200,000 will be tolerably safe for cereals, broadcast crops, established plants, or strong spreading rooted crops. Crops such as turnips or any late sown crops which occupy restricted portions of the field, and which are small during the summer months when the wireworms are feeding fast, may be damaged by this number. Below 100,000 wireworms per acre little damage need be feared and below 50,000 it is negligible.

Five years' cultivation appears to be sufficient to reduce the wireworms in ploughed up pastures to unobjectionable proportions. The reason for this will be plain when it is remembered

that they live on an average through five winters. As they are not extensively parasitised at any particular stage, nor likely to be preyed upon at one stage more than another, it is safe to assume that in a field of ploughed up turf they will be present in varying ages from one to five years in approximately equal numbers.

Assuming this to be the case there would be one-fifth normally hatching out into adults each year, and unless eggs were laid the effect on the total would be a diminution of one-fifth, so that even in the most serious cases five years would eliminate them. From a study of these fields this seems to be actually the case and this hatching out of adults and prevention of egg laying is the greatest factor in eliminating wireworms under cultivation.

Under ordinary farm conditions it seems difficult to increase very materially the above rate of elimination. Such birds as rooks and lapwings undoubtedly help a good deal, and so do poultry run on the fields while tillage operations are being carried out, when the soil is loose and the wireworms exposed. Intensive cultivation also helps considerably and shortens the period for elimination of the wireworms. It should be possible under intensive cultivation to shorten the period to three years instead of five, even if the wireworm content be considerably above 500,000 per acre.

The writer has on two occasions reduced to a negligible quantity in one season wireworm contents of 350,000 and 300,000 per acre. By intensive cultivation is meant continuous cropping by hoed crops or frequent cultivation in the brief periods between successive crops.

**Cropping of Infested Fields.**—A large number of different crops were planted in these fields during the years in question, and a careful record was kept of the effect of wireworms on each crop. The following is a summary of the observations made.

Of cereals oats proved easily the most satisfactory on wireworm-infested land. Where their number was large and there was consequently a considerable loss of plants the older varieties such as Sandy and Clemrothery gave better yields than the modern ones owing to their greater tillering power. Where, however, the loss of plants was not great the new varieties yielded better, although the crop looked much worse. Barley was the worst of the cereals for wireworm land and wheat intermediate. Rye was not tested sufficiently on these fields to enable one to form an opinion.

Beans are a tolerably safe crop where wireworms are numerous. The size of the whole root system compared with



the spacing of the plants makes it unnecessary for the wireworms to move about much. The best crop in the district was harvested on a field with 116,000 wireworms per acre. The only failure of beans was after dibbling very thinly. This practice seems to be unwise on such land.

Peas are nearly as safe as beans on their particular soils, but only if broadcast. Thin drilling in rows is risky, especially when the rows are more than a foot apart. As a rule peas cropped well on the six occasions when they were planted in these fields under observation.

Potatoes usually grow well, but if the wireworms are too numerous there may be gaps due to destruction of seed tubers or sprouts. The soil on ploughed up land is usually sour and on such land the potatoes do well. The looseness produced by the buried turf also favours the crop so that good growth is obtained. A proportion of the crop is holed by the insects and may be spoiled for market. This proportion will necessarily vary with the number of wireworms in the soil.

Swedes, turnips and mangolds are liable to serious damage by wireworms, and such damage will be increased if the rooks discover the field and come after the insects. These crops are drilled at a time when the wireworms are particularly active and they cannot be left unthinned or bulb formation would be prevented. They are very unsatisfactory crops for infested land, and only a specially favourable season producing rapid growth can save them. Of the cabbage tribe kales are the best to grow on such land as they can be left unthinned and still produce abundant forage. The wireworms will do a considerable amount of thinning, in which case neighbouring plants partially fill out the gaps. A crop of cabbages planted on the field from good strong plants can also do well in spite of large numbers of wireworms in the soil, provided the plants be kept growing. Linseed was never damaged on these fields, and in every case yielded the maximum crop that the season and particular soil permitted.

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## ANGORA RABBIT WOOL PRODUCTION:

### A PROFITABLE SPARE-TIME OCCUPATION.

W. WATMOUGH.

THE production of Angora rabbit wool has opened a new field to the utility rabbit breeder. This wool is so much in demand by spinners at the present time that 30s. to 40s. per lb. can be readily obtained for it, according to quality. At present the

demand is greatly in excess of the supply, and in order to encourage production enterprising firms of spinners exhibit at the leading rabbit shows displays of garments made from this wool. British spinners are said to prefer the wool produced by breeders in this country to that which is imported from abroad, but as they are unable to obtain home-produced supplies sufficient for their requirements, they are also buying extensively from France and other Continental countries. It therefore appears that the present time is favourable to an increase in the number of Angora rabbit breeders in this country.

The Angora is the only breed of rabbit that has a coat fine enough and long enough to justify its description as "wool" instead of "fur" or "hair." This wool grows rapidly from the time of weaning, and in a mature specimen reaches from 7 to 10 inches in length. It is described by spinners as being the finest material in the world for the weaving of certain classes of garments, *e.g.*, fine underwear, children's coats and caps, and as a trimming for court gowns. Further, the yarn is exported to America and other countries in considerable quantities.

Although Angoras are bred in various colours in addition to white (blues, smokes, fawns, etc.), the whites are the most popular and the most suitable for wool production.

Angoras are clipped about every three months. Approximately, one rabbit produces 10 oz. of wool per annum. Some specimens provide more, but breeders have found by experience that the wool from a single rabbit in one year can safely be calculated to be worth 30s., and that the animal's "keep" during that period will not exceed 10s., leaving a gross profit of 20s. If properly managed, therefore, 50 rabbits are capable of considerably increasing the income of persons who may be in a position to keep them properly.

It is not the writer's desire that anyone at this stage in the development of the Angora wool industry should endeavour to make this branch of live-stock culture his or her sole means of livelihood, but it can certainly be made to augment one's income. Neither does he advise the new enthusiast to aspire to the keeping of a head of rabbits exceeding about 100. Large wool farms may be developed, but they require experienced management, and paid labour has to be employed.

Wool is not the only product of the Angora rabbit. There are two others - pelts and flesh. The white skins are a good imitation of white fox. They are soft, warm and attractive. The pelts also supply the material for the making of necklets, muffs.





FIG. 1.—Angora Rabbit.





stoles, etc., and as linings for certain classes of garments they are said to have no equal. The coloured skins are used for similar purposes.

The meat of the Angora rabbit is excellent for the table. It is described by those who have tasted it as being more delicate, succulent and tender than the flesh of other breeds.

Although money may be made by the sale of the pelts and flesh, the writer's advice is that the rabbits—if suitable—should as a general rule, be kept alive and sheared for their wool. There is another point which all keepers of Angora rabbits should keep before them, and that is breeding for exhibition. Shows are held all over the country at which classes are provided for this breed of rabbit. There they can win many valuable prizes, and in consequence of these successes their value is so greatly enhanced that they may be sold at good prices, as much as £20 and £30 each being sometimes paid for good specimens. Further, a big winning buck can be placed at stud at a remunerative fee, and produce considerable revenue.

Angora rabbit wool is collected by the Universal Angora Club, an organisation of which every breeder should be a member. The wool should be sent to the Hon. Sec. (Mr. J. Holmes, 44, Old Birch, Darwen), who forwards it to the spinners every two months, and the producers receive their cash within a few days of the despatch of each consignment. Mr. Holmes will be pleased to forward particulars of the club and its work to anyone who contemplates commencing with Angoras. The annual subscription to the club is 5s., with 1s. entrance fee.

As regards housing and general management, the Angora differs but little in its requirements from other rabbits, and the necessary information can be obtained from ordinary text-books on the subject, or from the Ministry's Leaflet No. 265. In establishing a stud it is essential that stock of good quality and size should be purchased at the outset. The bucks and does should have coats of even length and fine texture. Rabbits should not be mated when moulty. Angoras are prolific breeders, and the usual litter is from four to eight.

In conclusion, it may be mentioned that Angora rabbit breeding is a particularly suitable hobby or side-line industry for women, among whom are some of the most successful breeders of the day.

## FEBRUARY ON THE FARM.

J. R. BOND, M.Sc.,

*Agricultural Organiser for Derbyshire.*

**Weather.**—The popular impression is that February is normally a wet month. Records extending over long series of years prove, however, that for the greater part of England the rainfall, on the average, is lower in this than in any of the other eleven months of the year except April. On well-drained land in the less rainy—the eastern and midland—parts of the country, the soil frequently is at this period dry enough for certain tillage and sowing operations. In the western districts, on the contrary, February is not normally a dry month, and here opportunities for early cultivations are comparatively rare. This difference has something to do with the proportions of arable and grass land on the two sides of the country.

February weather may be either very wet or very dry: in different years it tends towards the extreme in one or other direction. For instance, in 1921 rain fell in Derby on only 5 days during the month, the total rainfall for which was so low as 0.35 inch; but in the following year there were 18 wet days and a total of 3.03 inches of rainfall in the month. Similar variations may occur with regard to temperature. There is thus no certainty about the state of the land at this time of the year. Nevertheless, it not infrequently happens that opportunities missed in February do not return till late in spring; hence the advisability of being prepared to go forward with the sowing of one or other of the crops—rye, beans, peas, spring wheat, barley or winter oats—that may be put in a few weeks in advance of the ordinary spring seedings.

**Spring Wheat.**—If the farmer has at hand seed of any of the early-ripening varieties of winter wheat, such as Standard Red, Squarehead's Master, Victor or Little Joss, and if the land comes into sowing condition during February, he may sow and reasonably expect to reap a crop similar in yield and time of ripening to the produce of seed drilled late in November. In certain seasons, such as that following the severe winter of 1916-17, early spring sowings may give better results than crops put in before mid-winter.

It might be inadvisable to buy seed of any of the above four kinds for February sowing, excepting perhaps Little Joss. Squarehead's Master does well if sown early enough; but most of the recorded results from spring sowings of this variety



have shown it to be very unsatisfactory and liable to failure when sown after the end of February. Standard Red very closely resembles this variety and may for the purpose of these remarks be regarded as identical with it.

With Little Joss, sowings may if necessary be deferred until about the middle of March. It has been known to yield even better than Red Marvel when sown by the 15th of that month: for instance a farmer who occupied heavy land near Loughborough recently informed the writer that Little Joss sown on the 15th of March had, in 1921, and again in 1922, yielded him 7 quarters per acre, Red Marvel sown at the same time in 1921 producing a quarter less.

If a farmer intended to buy seed wheat now for sowing at the first opportunity, he would be adopting the safest course if he ordered Red Marvel. This variety, while yielding best when sown early, can in the good wheat districts be sown with reasonable likelihood of success at any time to the end of March. Its yields in trials conducted by agricultural educational institutions have been as follows:—

County.		Year.	Date of sowing.	Yield of saleable grain. Bushels per acre.
Essex (Institute)	...	1911	23rd February	53 and 45
"	"	"	20th March	48
"	"	1912	27th "	36 and 42
"	"	1913	11th "	35
Notts. (College)	...	1915	5th "	34
Herts. (Rothamsted)	...	1917	16th "	25 and 28
Yorks. (Garforth)	...	1922	22nd "	20

The usual rate of seeding is 3 bushels per acre, but a little more should be put on when broadcasting. Unless the land is in high condition it should receive a complete dressing of artificials.

**February Sown Oats.**—Oats sown this month escape the attacks of the frit-fly grub when later sown crops suffer severely; and on light dry land early sown corn often succeeds when crops put in later are badly checked by drought or overtaken by annual weeds, such as charlock and spurrey. Also on heavy land that bakes in the summer, a crop that shades the soil early has a distinct advantage over one that is late in covering the ground. Hardy oats may be preferable to spring wheat in the cooler districts: and on cold soils where neither spring wheat nor barley give satisfactory results, February oats have generally succeeded. Also in upland districts good and comparatively early crops of oats have been

obtained with hardy varieties, sown some weeks earlier than local opinion fixes as the proper time for sowing spring corn in those parts.

There is not quite the same distinction between winter and spring varieties in oats as there is in wheats: spring oats are capable of withstanding or recovering from the effects of moderate frost, while a very severe frost may almost destroy winter oats. Still, there is sufficient difference in hardiness to make it advisable to prefer varieties of the winter or half-bred winter oat class for February sowing. Bountiful (black winter) is the sort most commonly adopted for early sowing in Derbyshire; but the writer has seen good crops of Goldfinder (yellow half-winter) and of Marvellous (white winter) sown at the time in question. Bountiful and Goldfinder are well known to be useful as spring varieties; but when sown in March or April alongside the best spring sorts (such as Crown, Victory or Record) they ripen about a week later and yield rather less than the latter. Ordinary grey winters may also be sown in February or March and may be preferred for poor soils; on good moist land, however, they are too subject to lodging, and under these conditions the stiffer strawed and larger grained varieties are capable of higher yields.

The quantity of seed required differs according to the variety. Grey winters have small seeds and tiller well: 3 bushels per acre will suffice in this case. Marvellous has the opposite characteristics and probably 5 bushels would not be too much with this variety. Goldfinder and Bountiful require about 4 bushels. Special manuring is not, as a rule, called for. As regards cultivations, rolling, even where practicable, is usually inadvisable at this time of the year.

**Preparing for Root Crops.**—Land that was autumn- or winter-ploughed in unbroken seam often begins to assume a dry aspect early in the season (broken work may lie wet rather longer). This may be an opportunity for cross-ploughing, or of ploughing-back where cross cutting is not permissible. Rightly timed, a second ploughing is beneficial.

Where it has been or still is possible to spread the yard manure on the back of the furrow before cross-ploughing, the manure so applied will have decayed sufficiently and in time to allow of cleaning operations later in the spring. Turnips so manured are held to be less subject to fly troubles than crops to which the manure is applied in the ridges just before drilling. Early manuring affords certain other advantages in



the matter of the method of preparing the seed-bed for root crops.

Clean land intended to grow mangolds on the ridge may with advantage be manured in the ridge at the earliest opportunity in February or March: it is not necessary to wait until the land has been reduced to a fine dry tilth before drawing out the ridges and covering-in the manure. For this crop it is important to have a well-settled bed of soil under the seed.

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## MANURES FOR FEBRUARY.

H. V. GARNER, B.A.,

*Rothamsted Experimental Station.*

**Farmers' Field Trials.**—Costly mistakes in manuring grass land may often be avoided by conducting a preliminary small scale trial on the field in question. A common case is one where it is uncertain whether basic slag alone will be satisfactory or whether kainit or lime will be required in addition. Under these circumstances, and particularly if the area to be treated is extensive, a season may well be devoted to an experiment. Since in most cases phosphate will certainly be necessary the whole area will receive its dressing of basic slag at the required rate, which would normally be about 7 cwt. per acre of the 30 per cent. grade or its equivalent. A representative plot of about an acre is then chosen and a few drill widths of ground lime is applied across it at the rate of 15 cwt. per acre. The experimental area is then crossed with a similar strip of kainit at about 4 cwt. per acre applied at right angles to the lime. There will then be the following alternatives to choose from:—1. Slag alone; 2. Slag + kainit; 3. Slag + lime; and 4. Slag + lime + kainit. The boundaries of the treatments are marked and the plots kept under observation for a season, when a manurial scheme for the whole area can usually be decided on.

**Neutral Sulphate of Ammonia.**—Inquiries are often made as to the difference between neutral sulphate of ammonia and the ordinary grade. The neutral material is supplied as a dry powder resembling fine sand in texture; it can be stored for an indefinite time in a dry shed without becoming sticky or lumpy; it contains practically no free sulphuric acid and can therefore be kept in the bags in which it arrives. Ordinary sulphate of ammonia is coarser and damper in texture; it absorbs moisture on storage and tends to form hard lumps; and the small amount of free acid it contains causes the bags to rot.

The neutral grade is always ready for use and since it stores so well it can be purchased when prices are favourable and kept till required. Its dry condition makes it specially suitable for mixing with other fertilisers.

The following are analyses and recent prices :—

<i>Manure.</i>	<i>Ammonia,</i> <i>per cent.</i>	<i>Equivalent</i> <i>to Nitrogen,</i> <i>per cent.</i>	<i>Price per ton,</i> <i>Buyer's</i> <i>Station.</i>	<i>Price</i> <i>per</i> <i>unit N.</i>	<i>Free</i> <i>Acid, per</i> <i>cent.</i>
Neutral Sulphate of Ammonia ...	25 $\frac{3}{4}$ ...	21.2 ...	£15 2s. ...	14s. 3d.	.025
Ordinary Sulphate of Ammonia ...	25 $\frac{1}{4}$ ...	20.8 ...	£13 19s. ...	13s. 5d.	.1 to .5

**Manures for Barley.**—In working out a scheme for barley it is necessary to consider the effect of the manures on the quality of the grain as well as on the yield. Although season and soil have a much greater influence on quality than differences in manurial treatment, there is some experimental evidence as to the effect of manures, and this is being added to by the present experiments carried out under the research scheme of the Institute of Brewing at many centres throughout the country. Certain of the more definite conclusions from the earlier work may be summarised as follows :—

(1) Nitrogenous manures used alone tend to produce coarse grain of high nitrogen content and low quality. Unfortunately these manures are also the most effective in increasing the yield. The residues of heavy dunging or folding are similar in their action.

(2) Phosphates and potash improve the quality of the grain by increasing its starch and lowering its nitrogen content; but these manures have only a small effect on the yield, and unless used with a moderate supply of nitrogen, present in the soil or artificially applied, they are not likely to be remunerative.

(3) Complete artificial mixtures, such as, for example, 1 cwt. of sulphate of ammonia, 3 cwt. superphosphate, and 1 cwt. muriate of potash per acre, generally give a good yield of grain of high quality. On rich tilths it would be advisable to omit the sulphate of ammonia; on the heavier soils the potash could be reduced by one-half.

Regarding these statements in the light of the previous treatment of the land about to be drilled with barley, the following suggestions may be made :—After well done roots have been carted off, or after a straw crop on land in good condition, nothing will be required. If roots have been fed off by sheep receiving cake, the tilth will probably be too rich to grow first



quality barley, and to counteract rankness 3 cwt. per acre of superphosphate may be given, adding  $\frac{1}{2}$  cwt. per acre of muriate of potash or its equivalent on land which is known to respond to potash. After carted roots grown without dung, or after a corn crop on land in only medium condition, a mixture of 2 cwt. per acre of superphosphate and 1 cwt. per acre of sulphate of ammonia would be suitable; while on light gravels and chalks 1 cwt. per acre of muriate of potash (or its equivalent of the lower grade potash manures) would be advisable in addition to the above mixture.

**Kainit for Potatoes.**—Experience has shown that sulphate of potash is the safest form of potash to use for potatoes where quality is the main consideration, while muriate of potash is slightly inferior in this respect. Lower grade sources of potash such as  $12\frac{1}{2}$  per cent. kainit, 20 per cent. potash manure salts, and the various grades of sylvinite are less certain in their action and often give a crop of inferior cooking quality. This detrimental effect is attributed to the common salt which is applied to the soil with the potash when kainit or sylvinite is used. Farmers who have crude potash manures on hand and hesitate to apply them for potatoes in the drills in spring, should consider the possibility of making the applications in winter, or as early as possible in spring, thus allowing the common salt to be washed out by the rain, while the potash is held back in the soil for the use of the potato crop. If a deep furrow is to be given to the potato land, the potash manures had better be applied after this operation to prevent them from being buried too deeply.

It should be noted that the above procedure cannot make crude salts equivalent in their action to sulphate of potash; but crude salts applied in winter should be nearly as effective as an equivalent quantity of muriate of potash applied in the drills in spring.

**Leguminous Crops.**—Manurial experiments on these important crops have been relatively few, but all evidence goes to show that peas, beans, vetches, clover, sainfoin, lucerne, etc., show a marked similarity in their food requirements. They are all highly sensitive to sourness in the soil, and liming is a necessary preliminary to growing good leguminous crops on soils poor in chalk; their response to farmyard manure either as a direct dressing or even as residues from recent dunging is considerable; good results are obtained from phos-

phates alone on strong land, and from phosphates helped out by potash on light soils; while direct applications of quick-acting nitrogenous manures are often ineffective and may even be harmful.

If the cereal crop which nursed the young clover or sainfoin did not receive a good dressing of phosphate, an application of 4 cwt. per acre of superphosphate or basic slag on stiff land, and of 1 cwt. per acre of muriate of potash (or its equivalent of crude potash salts) in addition on lighter soils, may still be given to the seeds. Lucerne or sainfoin leys that were not manured last year may have a similar dressing.

Spring beans or vetches would benefit from a dressing of dung if any was available, and also about 3 cwt. per acre of superphosphate; but if dung is not used the superphosphate may be increased to 4 or 5 cwt. per acre, and on lighter soils 1 cwt. per acre of muriate of potash or its equivalent should be given in addition to the phosphate.

**Top Dressing Grass Land.**—Grass land which is to be mown this summer and has not received dung in the previous year, will usually need a spring dressing to give bulk to the hay crop. For this purpose there is available sulphate of ammonia, nitrate of soda, or nitrate of lime. Sulphate of ammonia provides nitrogen at the cheapest unit price and is especially suited to soils which are well supplied with lime; it is retained by the soil and comes into action by degrees as the land warms up; if cold wet weather follows a top dressing there is less likelihood of serious loss when nitrogen is given in this form. The nitrates are dearer when reckoned on their nitrogen content, but against this it must be borne in mind that they yield in the soil compounds of soda and lime which reduce the loss of chalk from the land and also set free some potash for the use of the grass. They are slightly quicker in their action than sulphate of ammonia and should on no account be applied until the grass is capable of making immediate growth. The usual rate of application of these manures is 1 cwt. per acre.

**Spring Wheat.**—On account of its short period of growth, spring wheat requires more generous manurial treatment than wheat drilled in autumn. Phosphates will be required to give the young plant a good start and to hasten ripening, and for this purpose superphosphate is preferable to basic slag on account of its somewhat quicker action in the soil. A ready supply of available nitrogen should be provided, and this may be given either as sulphate of ammonia mixed with the superphosphate



or as nitrate of soda as a top dressing. Suitable quantities for ordinary conditions would be :—3 cwt. per acre of superphosphate and  $1\frac{1}{2}$  cwt. of sulphate of ammonia applied before drilling; or 3 cwt. per acre of superphosphate before drilling and  $1\frac{1}{2}$  cwt. per acre of nitrate of soda as an early top-dressing. Potash is not required for corn on typical wheat land, but on lighter soils and chalks 3 cwt. per acre of kainit or sylvinite could be applied in addition to the above dressing.

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## PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending January 9th.				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. $15\frac{1}{2}$ per cent.) ...	...	13.15	13.10	13. 7	17. 3
" " Lime (N. 13 per cent.) ...	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. $25\frac{1}{4}$ per cent.)	13.19*	13.19*	13.19*	13.19*	(N)13. 5
" " " neutral (A. $25\frac{3}{4}$ per cent.)	15. 2*	15. 2*	15. 2*	15. 2*	(N)14. 3
Kainit (Pot. $12\frac{1}{2}$ per cent.) ...	...	...	...	2. 5	3. 7
" (Pot. 14 per cent.) ...	2.10	2. 6	2. 5	2.10	3. 7
Sylvinit (Pot. 20 per cent.) ...	...	...	...	2.15	2. 9
Potash Salts (Pot. 30 per cent.) ...	...	...	...	3.15	2. 6
" (Pot. 20 per cent.) ...	...	...	...	2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 5	7.10	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	...	11. 5	11. 5	4. 8
Basic Slag (T.P. 35 per cent.) ...	...	...	...	3.12§	2. 1
" (T.P. 30 per cent.) ...	...	...	...	2.17§	1.11
" (T.P. 26 per cent.) ...	2.13§	2. 0§	...	...	...
" (T.P. 24 per cent.) ...	2. 9§	1.16§	2. 0§	...	...
" (T.P. 20-22 per cent.) ...	...	1.13§	...	2. 5§	2. 3
" (T.P. 18 per cent.) ...	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.16	...	3. 7§	3. 7	1.11
" (S.P. 30 per cent.) ...	3. 9	3. 2	3. 0§	3. 2	2. 1
Bone Meal (A. $4\frac{1}{2}$ . T.P. 45 per cent.) ...	9.10	8. 5	8.15	8. 0	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6. 5	6. 5†	6. 5	6. 2	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	...	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

\* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

## MONTHLY NOTES ON FEEDING STUFFS.

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**Sugar Factory By-products.**—In the manufacture of sugar from sugar cane or sugar beet, by-products arise which are of value to the stock feeder. Molasses is the important by-product from the sugar cane which is of value to the stock feeder in this country. Notes on the feeding value of molasses have already appeared in these notes, and should be consulted by those desiring further details on the feeding value of this by-product.\*

**Sugar Beet Slices.**—The production of sugar from sugar beet has now reached a commercial stage in England, and considerable quantities of sugar beet slices are now on the market. In the process of manufacturing sugar, the beets are first washed and sliced, the slices being leached in a battery of extractors with warm water. The resultant slices contain very little sugar and may be fed either wet or dry.

Beet slices in their wet state contain 90 per cent. of water, and are chiefly fed to cattle. Fattening cattle and milch cows may be fed up to 50 lb. a head per day, while sheep and pigs may be fed up to 6 lb. per day per 100 lb. live weight. It is said that over-feeding milch cows with wet slices gives rise to hard white butter of inferior taste if the milk is used for butter making. Owing to the fact that wet slices readily decompose, it is usual to dry the slices at the factory at high temperature by means of a rotary drum. The resultant product has a pleasant odour and is greyish-brown in colour.

**Feeding Value of Dry Sugar Beet Slices.**—Like the wet slices, dried slices constitute a starchy feeding material, and should be fed in conjunction with feeding stuffs rich in protein and oil. If fed soaked the slices may be regarded as a root substitute, if fed dry, as a concentrate. The following quantities may be fed per head per day: Horses 5 lb., cows 7 lb., fattening cattle 10 lb., calves 2-3 lb., pigs 1-3 lb. The slices require soaking for at least 12 hours if it is desired to feed them in the wet state. If fed dry, it is important to accustom the stock to this material by gradually introducing it into the ration.

\* This *Journal*, November, 1921, p. 727.



DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.						
	s. d.	lbs.	s. d.	£ s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British - - -	—	—	10/3	10 5	0 16	9 9	71·6	2/8		1·43
Barley, British Feeding	—	—	9/9	9 15	0 12	9 3	71	2/7		1·38
„ Canadian No. 4 Western	34/9	400	9/9	9 15	0 12	9 3	71	2/7		1·38
„ Persian - - -	32/9	„	9/2	9 3	0 12	8 11	71	2/5		1·29
Oats, English, White - -	—	—	11/-	11 0	0 14	10 6	59·5	3/6		1·87
„ „ Black and Grey - - -	—	—	9/4	9 7	0 14	8 13	59·5	2/11		1·56
„ Scotch, White - - -	—	—	11/4	11 7	0 14	10 13	59·5	3/7		1·92
„ Canadian No. 2 Western	26/9	320	9/4	9 7	0 14	8 13	59·5	2/11		1·56
„ „ No. 3 „ - - -	25/9	„	9/-	9 0	0 14	8 6	59·5	2/9		1·47
„ Canadian Feed - - -	24/6	„	8/7	8 12	0 14	7 18	59·5	2/8		1·43
„ American - - -	24/3†	„	8/6†	8 10†	0 14	7 16	59·5	2/7		1·38
„ Argentine - - -	23/9	„	8/4	8 7	0 14	7 13	59·5	2/7		1·38
Maize, Argentine - - -	42/6	480	9/11	9 18	0 13	9 5	81	2/3		1·20
„ South African - - -	41/-	„	9 7	9 12	0 13	8 19	81	2/3		1·20
Beans, English Winter -	—	—	10/9	10 15	1 12	9 3	67	2/9		1·47
„ Rangoon - - -	—	—	8/3†	8 5†	1 12	6 13	67	2/-		1·07
Peas, Japanese - - -	—	—	22/6†	22 10†	1 8	21 2	69	6/1		3·26
Millers' Offals:—										
„ Bran, British - - -	—	—	—	7 10	1 7	6 3	45	2/9		1·47
„ „ Broad - - -	—	—	—	8 7	1 7	7 0	45	3/1		1·65
„ Middlings Fine (Imported)	—	—	—	10 5	1 2	9 3	72	2/6		1·34
„ „ Coarse (British)	—	—	—	9 0	1 2	7 18	64	2/6		1·34
Pollards (Imported) - -	—	—	—	7 15	1 7	6 8	60	2/2		1·16
Meal, Barley - - -	—	—	—	10 15	0 12	10 3	71	2/10		1·52
„ Maize - - -	—	—	—	11 0	0 13	10 7	81	2/7		1·38
„ „ South African	—	—	—	9 7†	0 13	8 14	81	2/2		1·16
„ „ Germ - - -	—	—	—	9 15	0 19	8 16	85·3	2/1		1·12
„ „ Gluten-feed - - -	—	—	—	8 17	1 7	7 10	75·6	2/-		1·07
„ Locust Bean - - -	—	—	—	8 5	0 9	7 16	71·4	2/2		1·16
„ Bean - - -	—	—	—	12 15	1 12	11 3	67	3/4		1·78
„ Fish - - -	—	—	—	20 0	4 6	15 14	53	5/11		3·17
Linseed - - -	—	—	—	23 8	1 11	21 17	119	3/8		1·97
„ Cake, English 9% Oil	—	—	—	13 15	1 18	11 17	74	3/2		1·70
Soya Bean Cake 6% Oil	—	—	—	12 0	2 14	9 6	69	2/8		1·43
Cottonseed Cake, English 5½% Oil	—	—	—	7 15	1 15	6 0	42	2/10		1·52
„ „ Egyptian 5½% Oil	—	—	—	7 10	1 15	5 15	42	2/9		1·47
Decorticated Cotton Seed Cake 7% Oil	—	—	—	12 0	2 14	9 6	71	2/7		1·38
Decorticated Cotton Seed Meal 7% Oil	—	—	—	12 7†	2 14	9 13	71	2/9		1·47
Coconut Cake 6% Oil -	—	—	—	9 15	1 11	8 4	73	2/3		1·20
Palm Kernel Cake 5% Oil -	—	—	—	7 10	1 3	6 7	75	1/8		0·89
Palm Kernel Meal 2% Oil -	—	—	—	6 0	1 4	4 16	71·3	1/4		1·71
Feeding Treacle - - -	—	—	—	7 0	0 8	6 12	51	2/7		1·38
Brewers' Grains:—										
„ Dried Ale - - -	—	—	—	8 2	1 4	6 18	49	2/10		1·52
„ „ Porter - - -	—	—	—	7 12	1 4	6 8	49	2/7		1·38
„ Wet Ale - - -	—	—	—	1 15	0 9	1 6	15	1/9		0·94
„ „ Porter - - -	—	—	—	1 10	0 9	1 1	15	1/5		0·76
„ Malt Culms - - -	—	—	—	8 10†	1 14	6 16	43	3/2		1·70

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 11s. per ton. The food value per ton is therefore £8 9s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 5d.; P<sub>2</sub>O<sub>5</sub>, 4s.; K<sub>2</sub>O, 2s. 6d.

From the point of gauging the price, roots form the best comparison. From experiments carried out at Little Snoring with fattening cattle some years ago, it would appear that 14 lb. of dried slices are equivalent to 1 cwt. of roots in feeding value.

FARM VALUES.

CROPS.	Market	Value	Starch	Food	Manurial	Value per
	Value per	per				
	lb. S.E.	unit	Equivalent	Value per	Value per	Ton on
	d.	S.E.	per 100 lb.	Ton.	Ton.	Farm.
		s. d.		£ s.	£ s.	£ s.
Wheat - - - - -	1·20	2 3	71·6	8 1	0 16	8 17
Oats - - - - -	1·20	2 3	59·5	6 14	0 14	7 8
Barley - - - - -	1·20	2 3	71·0	8 0	0 12	8 12
Potatoes - - - - -	1·20	2 3	18·0	2 0	0 4	2 4
Swedes - - - - -	1·20	2 3	7·0	0 16	0 2	0 18
Mangolds - - - - -	1·20	2 3	6·0	0 13	0 3	0 16
Good Meadow Hay - - -	1·52	2 10	31·0	4 8	0 14	5 2
Good Oat Straw - - -	1·52	2 10	17·0	2 8	0 7	2 15
Good Clover Hay - - -	1·52	2 10	32·0	4 11	1 0	5 11
Vetch and Oat Silage - -	1·38	2 7	14·0	1 16	0 7	2 3

\* \* \* \* \*

WITH reference to the note in the January, 1924, issue of this *Journal*, p. 887, relating to the closing of the Cattle Testing Station at Pirbright, Surrey, the Government of the Union of South Africa has prohibited the importation of cattle, sheep, goats and pigs from the United Kingdom, owing to the prevalence of foot-and-mouth disease. The regulations mentioned in the note above referred to are therefore in abeyance for the present.

\* \* \* \* \*



THE thirteenth Report of the Development Commissioners, for the year ending 31st March, 1923, has just been issued by H.M. Stationery Office.\* It contains a valuable record of the effort that is being made by the State to improve British agriculture by means of a complete system of education and research.

**Report of the  
Development  
Commissioners  
for the year  
1922-23.**

The purposes for which grants are at present given are as follows:—

- (1) Research Institutes and Stations, each dealing with a separate group of problems.
- (2) A staff of scientific men for advising farmers in their technical difficulties.
- (3) Special research grants to individual research workers.
- (4) Fellowships to enable members of the staffs of the Research and Advisory service to travel and study the methods of other scientific workers; and scholarships for training young graduates.
- (5) Agricultural education—building and equipment of colleges, extension work of colleges, farm institutes and classes provided by Local Education Authorities, scholarships.
- (6) Miscellaneous agricultural schemes.

The total amount recommended by the Commissioners for expenditure on agriculture and rural industries in 1922-3 was approximately £438,000, of which £16,450 was loaned. £214,000 of the total was provided by the ordinary Development Fund, and the remaining £224,000 came from the special grant of £850,000 which was paid into the Development Fund under the Corn Production Acts (Repeal) Act, 1921.

**The New Fund.**—The principal feature during the year 1922-23 was the allocation of this £224,000 from the new fund. The chief objects for which advances from it were made are:—

- (1) Additions to the lands and improvements to the buildings at research institutes and agricultural colleges.
- (2) Extension of the advisory scheme.
- (3) Increase of help to local authorities for agricultural education.
- (4) Provision for scholarships for children of agricultural workers.
- (5) A scheme for the development of the poultry and livestock industry.

*Agricultural Economics Service.*—This service, an extension of the Advisory Scheme, has been inaugurated during the year with the object of providing economic guidance for farmers. Economic studies were already being carried out at the Oxford Institute for Research in Agricultural Economics, and Leeds

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\* To be obtained directly or through any bookseller from H.M. Stationery Office, Kingsway, London, W.C. 2; or Manchester, Edinburgh, and Cardiff. Price 4s. net.

University had given much attention to the subject.\* The scheme provided for the enlargement of the Leeds department and the creation of new costings departments at Cambridge University, Reading University College, and Wye College. These will all work in conjunction with the Oxford Institute, and in the first instance will concentrate on preparing cost accounts for selected farms on a common plan.

*National Poultry Institute.*—The grant of £850,000 enabled those associated with the poultry industry to bring forward a scheme for the establishment of a long-desired poultry institute. Originally the promoters had in view the foundation of a single central institution, but a full examination of the project by the Ministry and its Poultry Advisory Committee led to the conclusion that better results would be got by dividing up the problems which face the poultry keeper under separate headings, most of which could be more effectively dealt with at existing institutions than at a single central institute. Accordingly a scheme has been adopted for work to be done on poultry nutrition at the Cambridge Animal Nutrition Institute, on diseases at the Ministry's Veterinary Research Laboratory, on breeding at the Cambridge University Department of Genetics, and on education and commercial problems at the Harper Adams Agricultural College. The capital required for buildings and equipment at these places is estimated at £26,000 and maintenance at £6,000 per annum. The Development Commission will provide three-fourths of the capital and the whole of the annual expenditure which they consider necessary.

*National Federation of Women's Institutes.*—This organisation has continued to show great vitality and powers of expansion, 455 new Institutes having been formed during the year 1921-22 and 347 during 1922-23, bringing the total number in existence up to 2,674 with a membership estimated at 160,000. The number of voluntary organisers trained by the Federation increased during the same period from 146 to 215. The formation of county federations has been further extended, the work being completed in the English counties, and only five Welsh counties being without federations. It should be borne in mind that the individual Institutes finance themselves and contribute to the maintenance of the headquarters staff and the county federations, and that the grant from the Development Fund goes

\* See this Journal:—*The Cost of Manual Labour in Milk Production*, August, 1922, p. 411; *Labour on the Farm*, Nov., 1922, p. 697, and Dec., 1922, p. 801; *When should the Farmer sell Home-Grown Foods*, Dec., 1922, p. 783; *Farm Capital and Profits*, Feb., 1923, p. 984.



towards the cost of organisation. It is a satisfactory sign of the strength of the movement that, in spite of the depressed condition of the agricultural workers, the call on public funds becomes less each year. For 1921-22 a grant of £7,250 (including £600 for training in handicraft work) was sanctioned by Your Lordships. For 1922-23 a grant of £4,825 (including £700 for handicraft purposes) was approved, but of this only £3,941 was actually paid over, while for 1923-24 it was found possible to reduce the grant to £3,456, of which £856 was for handicraft instruction. This progressive reduction was due partly to economies effected by the headquarters organisation and partly to an increase in the revenue derived from affiliation fees, interest on the endowment fund, donations and sales of literature, which actually amounted to £3,781 for the year 1922-23, and was estimated at £4,350 for the year 1923-24. At the end of the year 1922-23 the Endowment Fund stood at approximately £14,115. The Federation is now extending its handicraft teaching to others besides Institute members. Classes for men and boys will be given by teachers trained at the Handicrafts Schools, and an effort will be made to organise the production of work for sale (as distinct from recreational and thrift work) by village women wherever the demand arises. It is hoped that this may do something to relieve distress arising from the depression in agriculture.

*Agricultural Education.*—A striking result obtained from the new fund is the re-establishment of the Royal Agricultural College, Cirencester, which was closed during the War, as nearly all the staff and students had joined the Forces. The Development Commission recommended a capital grant of £15,000 for extending the existing buildings, and £2,000 in aid of the first year's maintenance, and the College was re-started at the beginning of the academic year with a good entry of students.

*Scholarships for Agricultural Workers.*—£100,000 of the new fund has been allocated to establishing scholarships and maintenance allowances for the sons and daughters of agricultural workmen and others. The Ministry of Agriculture and the Board of Education set up a Committee to prepare a scheme for the expenditure of this sum. and as a result, ninety-two scholarships were awarded for 1922-23, at an estimated cost for that year of £10,000. For the next year £20,000 has been approved.

The above are no more than examples of the work supported by the Development Fund. All who are interested in agricultural development will find in the complete report an illuminat-

ing account of the progress already made in agricultural research and education and the prospects opened up by it.

\* \* \* \* \*

WITH a view to encouraging small holders in the best methods of cultivating their holdings, prizes have been offered at some recent agricultural shows for the best cultivated small holdings in the district. One of the Ministry's District Commissioners has seen the prize-winning holdings under a competition of this kind organised by the Hertfordshire Agricultural Society, and reports that they do the tenants great credit. Similar competitions have been or are about to be arranged in connection with several other agricultural shows, including that of the Bath and West and Southern Counties Agricultural Society, and these should have a very stimulating and beneficial effect on the small holders in the districts concerned.

It is interesting in this connection to note that several cases have been brought to the Ministry's notice where prizes of various kinds in open competitions have been won by tenants of County Council small holdings. A Westmorland holder was successful with a pen of ducks bred by him in winning the *Daily Mail* Cup in 1923 in an Egg-Laying Competition over a period of twelve months open to Britain. Numerous successes by tenants of the Leicester County Council have been obtained at various live-stock shows in the county during the past year, and the possibility of organising special classes for small holders at next year's shows in Leicestershire is under consideration.

A further instance of the enterprise and success of small holders is afforded by the fact that no fewer than 76 entries by tenants of the North Riding of Yorkshire County Council were made at the Rural Industries Exhibition, and 5 first, 7 second, and 7 third prizes were secured, chiefly for roots and ears of corn.

\* \* \* \* \*

THE general index number of the prices of agricultural produce showed a further slight advance in December, the average

**The Agricultural  
Index Number.**

increase over the corresponding month in the years 1911-13 being 56 per cent. as against an increase of 53 per cent. in November. The rise during the past two months has thus brought the general level of prices to only 3 points below that of December, 1922.



In the following table are shown the percentage increases monthly since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January ... ..	200	183	75	68
February ... ..	195	167	79	63
March ... ..	189	150	77	59
April ... ..	202	149	70	54
May ... ..	180	119	71	54
June ... ..	175	112	68	51
July ... ..	186	112	72	53
August ... ..	193	131	67	54
September ... ..	202	116	57	56
October ... ..	194	86	59	51
November ... ..	193	79	62	53
December ... ..	184	76	59	56

Following the improvement in wheat prices which occurred during November, the December figure showed a further decided advance, averaging 33 per cent. above the pre-war price as against 22 per cent. in November. The end of the month witnessed a somewhat easier tendency, however. Oats also realised considerably higher prices than in the previous month, but barley was slightly cheaper, although the fall was less pronounced than is customary at this period.

Potatoes again advanced, December prices being nearly £1 per ton higher than those for October, and little less than double the pre-war average. There is no weakening in the markets, and further advances are probable in the near future. Hay remains at about its pre-war level.

Fat cattle and sheep advanced in value in December, but whereas the rise in cattle prices was relatively greater than the normal increase before the war, sheep advanced by less than the pre-war average. Hence the index figure for cattle shows a rise on the month, while that for sheep shows a fall. Fat pigs continued the downward trend which had only twice been interrupted since the beginning of the year. The prevalence of foot-and-mouth disease and the consequent restrictions imposed upon trade, prevented the calculation of average prices of store stock and dairy cows in December.

The main cause of the advance of 3 points in the general index number was the rise in milk prices. Under the 'National Farmers' Union scheme producers received 1s. 8d. per gallon in December, for milk delivered to buyer's station, as compared with 1s. 5d. in November, and although the scheme is not operative throughout the country and has not been universally

adopted, the general level of prices rose from 75 per cent. above the pre-war average in November to 90 per cent. in December. Butter also advanced, but cheese was slightly cheaper than in November.

A substantial advance was recorded in poultry prices during the month, far exceeding the normal pre-war increase at this season, with a resulting increase of 19 points in the index number. Eggs, on the other hand, declined to a relatively greater extent than was usual before the war, and the index number for December is 6 points lower than that for November.

The following table shows the average increases during recent months in the prices of the principal commodities :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922.		1923.				
	Dec.	August	Sept.	Oct.	Nov.	Dec.	
Wheat ...	32	29	19	20	22	33	
Barley ...	17	9	30	25	25	27	
Oats ...	36	30	30	25	24	30	
Fat cattle ...	48	46	45	44	47	49	
Fat sheep ...	81	76	72	76	77	72	
Fat pigs ...	94	52	55	48	47	43	
Dairy cows ...	72	51	52	61	57	—	
Store cattle ...	28	28	27	27	25	—	
Store sheep ...	83	101	109	99	88	—	
Store pigs ...	151	102	95	82	75	—	
Eggs...	63	68	75	92	92	86	
Poultry ...	86	61	67	65	58	77	
Milk ...	90	67	67	72	75	90	
Butter ...	73	48	56	61	64	68	
Cheese ...	60	67	74	76	73	71	
Potatoes ...	7	80	75	62	80	91	
Hay ...	47	34	32	7	—1*	0	

\* Decrease.

\* \* \* \* \*

THE Corporation of Birmingham has long been noted for its municipal activities. Its gas, electric light and water depart-

**Manures from  
Town Waste.**

ments have all been very successful, but a department which has only been running a few years and deals with town waste is of special interest to farmers, who, however, have not yet made the direct use of it that they might.

Under the direction of Mr. J. Jackson, its Superintendent, a great "Wealth from Waste" campaign has been started by the Salvage Department, and as a result, manures and feeding stuffs



of various types are now available at a reasonable rate. For instance, 4,000 tons of slaughter-house and similar material is dealt with every year, yielding nearly 1,000 tons of the finished product. This includes fish and meat meals with 51 per cent. of albuminoids, together with fish, meat, bone and other manures with varying analyses, which are priced according to the unit value.

What is known as slaughter-house manure contains 6 to 7 per cent. of ammonia and the same percentage of phosphates, and is offered at £8 10s. f.o.r. Birmingham. It is produced from the stomach contents of various beasts and contains a large amount of humus in the form of fibre. In other forms the fibre is taken out so that the manure can be drilled. The fibre is in great demand by hop and fruit growers. One of the most interesting of the productions, although naturally there is only a limited supply, is the ash made by burning banana stalks. This fertiliser contains 50 per cent. of potash.

Farmers in the neighbourhood of Birmingham have produced good crops by the use of these products. There is no trouble in getting rid of the 17 to 18 tons that are available each week, and most of it is readily sold to middlemen who apparently use it for compounding artificial manures.

Another material which can hardly be called manure, but which is very useful on heavy land, is the dust from household refuse, which has passed through a  $\frac{3}{8}$ -in. sieve. At present it only contains 1 per cent. of nitrogen and 1 per cent. of phosphates, but it is hoped to increase this percentage by adding vegetable refuse. At present this can be delivered within a few miles of Birmingham at 4s. or 4s. 6d. per ton.

The Department has an analytical laboratory with a trained staff and is able both to analyse the various materials and to give advice as to any necessary additions which should be made for specific crops. Not only farmers but allotment holders are catered for by this Department, and prices are quoted for quantities as low as 14 lb. either at the depot or delivered anywhere in Birmingham for a few pence extra.

\* \* \* \* \*

THE Treasury, on the recommendation of the Development Commissioners, have approved grants to Agricultural Research

<b>Grants to Research Institutes.</b>	Institutes for work to be carried out during the year ending 30th September, 1924, as shown in the statement below :—
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INSTITUTE.	GRANT SANCTIONED. £
Aberystwyth : Plant Breeding Institute ... ..	5,800
Bristol : Agricultural and Horticultural Research Station	11,800
Cambridge : Animal Nutrition Institute ... ..	9,700
Plant Breeding Institute ... ..	5,600
Small Animal Breeding Institute ... ..	1,150
Horticultural Research Station ... ..	1,420
Silver Leaf Research ... ..	1,550
East Malling Research Station ... ..	6,300
Imperial College of Science and Technology ... ..	5,100
London School of Tropical Medicine ... ..	2,550
Oxford : Institute for Research in Agricultural Economics ... ..	4,950
Reading : National Institute for Research in Dairying	8,800
Royal Veterinary College ... ..	4,500
Rothamsted Experimental Station ... ..	22,780
Waltham Cross Experimental Station ... ..	2,000
	<hr/> £93,170

\*            \*            \*            \*            \*            \*

It is not surprising that goat-keepers should have taken note of the success of the Ministry's scheme of milk recording for cows. The more advanced goat breeders have come definitely to the conclusion that milk recording for them has become a necessity if they are to improve their milking herds and keep abreast of the times.

### **Milk Recording for Goat-Keepers.**

For some years the subject has been discussed in the goat press, and about four years ago the Ministry agreed that goats might be recorded under its scheme on the same conditions as cows, if the milk recording societies concerned considered the size of the herd would justify the labour and expense incurred in checking the records.

As a result of this permission, eleven goat owners recorded 85 goats during the year ending 1st October, 1922, and nearly double that number of goat owners are now recording under the official scheme.

These eleven owners are members of six different milk recording societies. Of the five herds which were recorded for the full year of operations, four herds contained goats which gave records of between 200 and 300 gallons.

Under the official scheme the cost per head of recording is of course much higher, proportionately, for goats than for cows, taking into account the respective values of the animals and the amounts of milk given. The goat keeper is also adversely affected by the fact that herds of goats are on an average very much smaller in numbers than are herds of cows. Thus



the minimum charge per herd which is made by milk recording societies is not always reached by the total of the subscriptions and the levies for each goat entered.

The fact that milk recording for goats is advancing in spite of these obstacles indicates strong belief among goat owners in the value of membership of a Society recognised by the Ministry.

Subscriptions and levies charged by milk recording societies vary considerably in different parts of the country. The following are the charges made by those societies under which goats are recorded :—

<i>Society.</i>	<i>Subscription.</i>		<i>Levies.</i>	
Surrey	...	10/6	..	5/- per head *Min. £5 10 6 per herd
Hants	...	5/-	...	5/- " " £4 0 0 "
Essex	...	£1 1 0	...	3/- " " £1 10 0 "
Northants	...	10/6	...	4/- " " £3 0 0 "
Lancs	...	£2 0 0	...	4/6 " " £2 5 0 "
Worcester	...	£1 0 0	...	5/- " " £2 0 0 "
			* Minimum.	
	*	*	*	* * *

## AGRICULTURE ABROAD.

THIS new potato wart disease order, issued by the Prussian Minister of Agriculture on 27th September, 1922, is an amendment of that of 18th February, 1918, and applies to the entire State of Prussia.

### Wart Disease Regulations in Prussia.\*

Potato fields and stored potatoes are liable to inspection, with a view to the control of wart disease [*Synchytrium endobioticum*]. Inspection may be extended to fields intended for potato cultivation or which have already been harvested. It will be carried out by the local police authorities and officials of the plant protection headquarters. The inspectors are authorised to remove suspected tubers, etc., for examination. Owners and occupiers of ground and stores or their representatives observing symptoms of wart disease (described in an appendix), on growing or stored potatoes are required to notify within 24 hours the police or local authorities, who in their turn must immediately inform the plant protection headquarters. The decision of the latter or their representatives is final.

The refuse of plants growing in infested fields must be carefully collected and burnt, or buried at least half a metre deep where burning is impossible. Potatoes harvested from infested fields must neither be used for seed nor removed from their

\*See *Nachrichtenblatt für den deutschen Pflanzenschutzdienst*, ii, 12, pp. 102-104, 1922.

place of growth without permission from the police, issued on approval by the plant protection headquarters. They can only be used for fodder when cooked or steamed. The residue from such potatoes must also be burnt. Where factories for the preparation of potato products are near by, it is best to hand over the tubers from contaminated fields to such factories, but any unnecessary movement of the tubers is to be avoided on account of the danger of transmitting infection in particles of soil adhering to them.

Only the potato varieties specially authorised by the local police authorities may be cultivated in infected fields until further notice. Removal of such restriction must be approved by the plant protection headquarters. The only varieties admissible for this purpose are those listed as immune from wart disease in the annual circular of the Biological Institute. Seed potatoes are to be procured only from fields approved by a Chamber of Agriculture, the Potato Cultivation Society, the German Agricultural Association, or the National Agricultural Federation. Stable or liquid manure must not be sold by, or otherwise distributed from, infected farms. Cellars and other rooms employed for the storage of diseased potatoes must be disinfected with limewash after use.

The above regulations do not apply to official experiment stations, in the case of scientific research, or to the removal of samples by the inspection authorities.

In case there is ground for suspicion that the infection has been, or is likely to be, transmitted to other fields, the above regulations may be applied to all the fields within an area to be defined by the police authorities in accordance with the finding of the plant protection headquarters.

If infected potatoes are found elsewhere than on agricultural premises the stock must also be rendered harmless or disposed of for manufacturing purposes under the supervision of the local police authorities.

\* \* \* \* \*

A NOTE in this *Journal*, September, 1923, p. 560, described a French and Belgian system of competitions intended to

**Seed Grain  
Competitions  
in Quebec.**

secure the widespread adoption of the results of modern research in crop breeding. Competitions with the same object have also been carried on in the Canadian province of Quebec since 1919.\* These competitions are designed to encourage the use for seed of the grain produced.

\* *Agriculture Gazette of Canada*, Sept.—Oct., 1923.



Farmers desiring to enter the competition are required to own a certain amount of seed grain of standard quality and of a known variety approved by the Department of Agriculture. The standing crops entered by their growers are inspected and points are given for the general appearance of the crop, absence of weeds and diseases, system of cultivation, etc. The interesting feature of the competitions is that the farmers are then required to prepare a large proportion of the grain for seed. An inspection of the cleaned seed is made and points given according to the thoroughness of the work done during the course of all the operations.

This constitutes the difference between the combined field crop and cleaned seed competition and the former standing crop competitions, and prevents well-to-do farmers from putting their crops into the competition as a speculation without any results as regards the improvement of cereal crops by the more general use of improved seed.

The contests are organised under the auspices of the agricultural associations, with the co-operation of the Provincial Department of Agriculture. During the three years, 1920-23, the annual number of competitions has increased from 16 to 29 and the entries from 472 to 1,297. In the third year 28,400 bushels of seed oats and 7,500 lb. of clover seed were inspected.

The increase in the number of contests and entries suggests their popularity among farmers and the benefits derived from them. The consensus of opinion is that the competitions are a means of distributing good varieties of crops among the farmers, that they encourage the use of methods of selection, and create an *élite* of farmers who are able to produce seed of good quality of uniform variety, and well adapted to climatic and soil conditions. It is hoped that as the work becomes generalised throughout the province the average yield of crops will show a decided increase.

\* \* \* \* \*

A COMMISSION of Investigation has recently been inquiring into the organisation of the system of distributing foodstuffs in Sweden. In its report, it states that owing to the increase in prices during the War and the withdrawal of State control thereafter, middlemen found themselves in a position to obtain unreasonable profits in many directions. Latterly, however, values had considerably declined, and with the unusually abundant supplies of goods,

**Agricultural  
Prices and  
Distribution in  
Sweden.**

the evil had to a large extent disappeared. In consequence the Commission did not recommend any interference by the State with ordinary economic conditions in Sweden at the present time. It did, however, recommend that Local Authorities should make themselves acquainted with the local circumstances of important trades and assist them where they could in reducing expenses through representations to transport authorities, etc. The Commission expresses its firm conviction that the co-operation of consumers and producers forms the best means of removing any undue expense of intermediate services in the marketing and sale of commodities, and it recommends that an intensive educational campaign should be carried out to bring the fact home to those concerned.

The Commission also submitted that the Government should (1) order that a continuous service of statistics of producers' prices should be organised; (2) that Communal Prices Committees should be set up to watch prices in towns or districts; (3) that obligatory instruction in economic theory and practice be given in suitable schools; (4) that Parliament should vote 10,000 crowns annually as a contribution to a central organisation for the development of economic co-operation.

\* \* \* \* \*

**Foot-and-Mouth Disease.**—Since 12th December, 1923, the following fresh centres of disease have been brought to light:—

- |      |                 |                              |
|------|-----------------|------------------------------|
| (1)  | On 15 December, | Deal, Kent.                  |
| (2)  | „ 18 „          | Ulverston, Lancs.            |
| (3)  | „ 19 „          | Norwich.                     |
| (4)  | „ 24 „          | Whitehaven, Cumberland.      |
| (5)  | „ 29 „          | Boreham, Chelmsford.         |
| (6)  | „ 30 „          | Sulby, Northants.            |
| (7)  | „ 30 „          | Mildenhall, Suffolk.         |
| (8)  | „ 30 „          | Macduff Gamrie, Banff.       |
| (9)  | „ 31 „          | Aldborough, Yorks, E.R.      |
| (10) | „ 5 January,    | Silverstone, Northants.      |
| (11) | „ 8 „           | Carmythe, Forfar.            |
| (12) | „ 12 „          | Ely, I. of Ely.              |
| (13) | „ 14 „          | Kirkby Stephen, Westmorland. |

*Outbreaks.*—The table on p. 1077 shows the number of outbreaks during the period 12th December, 1923, to 19th January, 1924, inclusive, and during the outbreak from 27th August last.

*Restrictions.*—With the release of the controlled area on 15th December, 1923, the general restrictions, so far as movement of animals is concerned, have remained practically unchanged, save for the variation of the limits of the infected areas from time to time on account of the new outbreaks or of the cessation of disease in some districts.



## FOOT-AND-MOUTH DISEASE, 1923—1924.

England and Wales.			Dec. 12-15.	Week ending Dec. 22.	Week ending Dec. 29.	Week ending Jan. 5.	Week ending Jan. 12.	Week ending Jan. 19.	Total during Outbreak from 27 Aug., 1923, to 19 Jan., '24.
Bedford	...	...	—	—	—	—	—	—	1
Birmingham	...	...	—	—	—	—	—	—	6
Chester	...	...	137	190	212	160	110	63	1,312
Cumberland	...	...	—	—	4	5	4	1	14
Denbigh	...	...	1	8	3	3	3	—	79
Derby	—	...	1	1	3	3	3	3	21
Devon	...	...	—	—	—	—	—	—	4
Durham	...	...	10	5	2	1	4	2	91
Essex	...	...	—	—	1	—	—	—	6
Flint	...	...	3	14	6	4	7	5	77
Gloucester	...	...	5	5	4	—	3	4	59
Isle of Ely	...	...	—	—	—	—	1	—	1
Kent..	...	...	1	3	—	—	1	—	8
Lancaster	...	...	2	9	12	8	8	5	79
Leicester	...	...	—	1	2	2	2	1	15
Lincs., Lindsey	..	...	—	—	—	—	—	—	2
London	...	...	—	—	—	—	—	—	1
Monmouth	...	...	—	—	—	—	—	—	1
Norfolk	..	...	—	1	—	2	2	—	10
Northampton	...	...	—	—	—	2	—	3	5
Northumberland	...	...	5	7	4	3	5	4	71
Nottingham	...	...	—	—	2	—	—	—	3
Salop	...	...	11	20	20	19	16	9	151
Somerset	...	...	—	—	—	—	—	—	7
Southampton	...	...	—	—	—	—	—	—	7
Stafford	...	...	1	6	18	21	10	4	71
Suffolk	...	...	—	—	—	2	1	—	3
Surrey	...	...	—	—	—	—	—	—	7
Sussex, East	...	...	—	—	—	—	—	—	1
Warwick	...	...	3	1	2	4	—	1	13
Westmorland	...	...	—	—	—	—	—	1	1
Worcester	...	...	2	5	2	3	3	1	26
York, East Riding...	...	...	—	—	—	1	1	3	8
„ North „	...	...	—	3	7	4	2	1	22
„ West „	...	...	5	7	6	3	1	2	85
TOTALS — England and Wales			187	286	312	250	187	113	2,268
Scotland.			Dec. 12-15.	Week ending Dec. 22.	Week ending Dec. 29.	Week ending Jan. 5.	Week ending Jan. 12.	Week ending Jan. 12.	Total during Outbreak from 27 Aug., 1923, to 19 Jan., '24.
Aberdeen	...	...	—	—	—	1	—	—	4
Ayr	...	...	1	—	—	—	—	—	4
Banff	...	...	—	—	—	2	3	—	5
Dumbarton	...	...	1	1	—	—	—	—	23
Kinross	...	...	—	—	—	—	—	—	1
Fife	...	...	1	—	2	1	—	—	5
Forfar	...	...	—	—	—	—	1	—	1
Lanark	...	...	4	1	3	2	2	2	26
Perth	...	...	—	—	—	—	—	—	5
Renfrew	...	...	—	—	1	—	—	—	25
Stirling	...	...	—	1	2	—	—	—	14
TOTALS—Scotland			7	3	8	6	6	2	115
TOTALS — Great Britain...			194	289	320	256	193	115	2,383

As from 4th January, 1924, a consolidating Order was issued restating the various areas, other than those in the North Midlands (Ches., &c., Area), Kent, Renfrew district, Fife and Perth district, Aberdeenshire, and Forfarshire, comprised under separate Orders.

*Restrictions on Hunting.*—On 19th December, 1923, a Circular Letter was issued by the Minister intimating that in consequence of strong representations from the National Farmers' Union and from farmers individually, it had been decided to issue an Order prohibiting hunting in infected, controlled or prohibited areas. The Order, which operated on 24th December, also prohibited whippet-racing and coursing.

*Restrictions on Imported Animals.*—On the 20th December the Ministry extended the period of detention at the farms of destination of all imported animals from 14 to 23 days. The movement of imported animals is now permissible only direct to a slaughterhouse for slaughter therein, or to private premises for detention for the period specified, during which no movement is permitted.

*World's Poultry Congress, 1924.*—People who are interested in the development of the British Poultry Industry should bear in mind the World's Poultry Congress and Exhibition, which will be held in Barcelona and Madrid in May next. Programmes are now available for this gathering of poultry-keepers from all over the world, and there is sufficient evidence forthcoming to indicate that the Congress will not only be of great interest to all who attend it, but that it may prove to be a unique opportunity for British breeders to secure fresh markets abroad.

Special terms and arrangements are being made for those who wish to attend the Congress from this country. The outward journey would be via London, Newhaven, Dieppe, Paris, Port Bou, and Barcelona, returning via Madrid, Burgos, Biarritz, Paris, Dieppe, to London. The special fares are as follows:—1st Class, £12 18s. 9d.; 2nd Class, £9 5s. 2d. (Sleeping berths extra, also the cost of transfer between stations in Paris.) The journey to Barcelona and on to Madrid must be taken by the party (of not less than 25) without a break, but the return journey can be made at will and be broken to see places of interest en route. Application for tickets and further particulars should be made to Mr. T. R. Robinson or Mrs. Rawson, at 3, Vincent Square, London, S.W.1.

It is to be hoped that this country will be adequately represented at the Congress, for delegates will be coming from 30 countries who have signified their intention of being officially represented. South America in particular will be well represented by prospective buyers. There is also some promise that a good market for high class poultry stock could be found in Spain itself.

*Registers of Growers of Certified Immune Varieties of Potatoes in 1923.*—During the past season, Inspectors of the Ministry of Agriculture have examined many fields of growing potatoes of varieties immune from wart disease, with a view to certification of the crops under the Wart Disease of Potatoes Order of 1923 as true to type and free from "rogues." A list of growers of these certified stocks has been prepared and copies may be obtained, price 1s., from the Ministry, which will also be happy to supply on application the names and addresses of growers of certified stocks of any particular variety, together with the numbers of the relative certificates. Growers



are reminded that only "seed" from crops which have been so certified may be planted on land which is infected with wart disease.

The Board of Agriculture for Scotland has issued a similar register of Scottish growers with the acreages and kinds of potato crops certified, together with certificate numbers. Copies can be obtained from the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh, price 2s. net, post free.

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## REPLIES TO CORRESPONDENTS.

**Period of Growth of Crops.**—V.W. asks for information as to the average time in which various crops become available after dates of sowing.

*Reply:* It is almost impossible to give any categorical information on this subject. Much will depend on the variety sown as well as on climatic, soil and weather conditions. For instance, at Rothamsted Experimental Station, in 1922, two crops of Red Standard Wheat sown within five days of each other (on 24th October and 29th October, 1921) were carted respectively on 7th September and 26th September, 1922. Plumage Archer Barley in 1921 was carted in a day over five calendar months from sowing; in 1922 the same crop on the same field took practically six months from sowing to harvest.

**Starch Equivalent and Albuminoids.**—X.Y. asks for information.

*Reply:* The significance of these terms is explained in the introduction to the Ministry's Miscellaneous Publication No. 32 (*Rations for Live Stock*). In compounding rations, regard must be had to the proportion of digestible protein (albuminoids) to starch equivalent. This is explained, as regards the feeding of dairy cows, in Leaflet No. 388, and, as regards pigs, in Nos. II and III of a series of articles on Pig-Keeping in this *Journal*. (The articles referred to appeared in the October and November issues of last year.) In purchasing feeding stuffs, the simplest guide to money value is the starch equivalent. See the table published monthly in this *Journal*.

**Pollination of Vegetable Marrow.**—B.D. inquires as to this.

*Reply:* The Vegetable Marrow may safely be said to be normally insect-pollinated. Knuth (*Handbook of Flower Pollination*, vol. 2) does not expressly refer to the Vegetable Marrow, but mentions the honey-bee as frequently visiting the flowers of the Pumpkin, which belongs to the same genus as the Vegetable Marrow. On the general question of insect-pollination correspondent was referred to Lord Avebury's *British Wild Flowers considered in Relation to Insects*.

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## ADDITIONS TO THE LIBRARY.

### Agriculture, General and Miscellaneous.

*Russell, Sir E. J. and others.*—The Micro-Organisms of the Soil. [Rothamsted Monographs on Agricultural Science.] (195 pp.) London: Longmans, Green & Co., 1923, 7s. 6d. net. [63.115(02).]

*Bornemann, F.*—Kohlensäure und Pflanzenwachstum. 2te Auflage. (138 pp.) Berlin: Paul Parey, 1923. [58.11(04); 63.168(04).]

*Wiest, E.*—Agricultural Organisation in the United States. (640 pp.) Lexington: University of Kentucky, 1923. [35(73); 63(73).]

*Bruttini, A.* (*International Institute of Agriculture*).—Uses of Waste Materials: The Collection of Waste Materials and their Uses for Human and Animal Food, in Fertilisers and in Certain Industries, 1914-22. (387 pp.) London: P. S. King, 1923, 12s. [58.16(02); 63.16(02); 63.60432(02); 664.3(02).] Reviewed in the January issue of this *Journal*.

**Field Crops.**

- Boas, F. und Merckenschlager, F.*—Die Lupine als Objekt der Pflanzenforschung: Morphologie, Anatomie, Physiologie und Pathologie der gelben Lupine. (152 pp.) Berlin: Paul Parey, 1923. [63.33(d).]
- Royal Agricultural Society of England.*—Sowing Land Down to Grass. (6 pp.) London, 1923. [63.33(a).]
- Robertson, G. S.*—Phosphates and Improvement of Pasture. (9 pp.) Belfast: Ministry of Agriculture, 1923. [63.33-16.]
- Rouest, L.*—Le Soja et son Lait Végétal: Applications Agricoles et Industrielles. (161 pp.) Paris: Librairie des Sciences Agricoles, 1921, 10fr. [63.321.]
- Midland Agricultural and Dairy College.*—Report on Field Experiments with Potatoes carried out on the College Farm 1921-23: (a) Varieties, (b) Potash Manures, (c) Maximum Manuring, (d) Local v. Scotch Seed. (14 pp.) Sutton Bonington, Loughborough, 1923. [63.512(04).]

**Horticulture.**

- Rockwell, F. F.*—Gardening Under Glass. (307 pp.) New York Garden City: Doubleday, Page & Co., 1923, \$3.50. [63.5-19.]
- MacDonald, J.*—Lawns, Links, and Sportsfields. (87 pp.) London: "Country Life" and George Newnes, 1923, 5s. [63.53(02).]

**Plant Pests and Diseases.**

- Wardle, R. A. and Buckle, P.*—The Principles of Insect Control. (306 pp.) Manchester: University Press; London: Longmans, Green & Co., 1923, 20s. [59.16(02); 63.29(02).]
- Lejroy, H. M.*—Manual of Entomology, with special reference to Economic Entomology. (547 pp.) London: Edward Arnold & Co., 1923, 35s. net. [59.16(02); 59.57(02).]
- California Agricultural Experiment Station.*—Bulletin 364: Fungicidal Dusts for the Control of Bunt. (40 pp.) Berkeley, 1923. [63.24.]

**Livestock.**

- Benedict, F. G. and Ritzman, E. G.*—Undernutrition in Steers: Its Relation to Metabolism, Digestion, and Subsequent Realimentation. (340 pp.) Washington: Carnegie Institution, 1923, \$3.25. [612.394(02).]
- Lynn, J. C.*—Practice with Science in the Feeding of Farm Stock. (11 pp.) Hull: British Oil and Cake Mills, Ltd., 1923. [63.6043(04).]
- Frature, J. L.*—The Age of the Horse according to the Teeth. Translation by G. Mayall. (65 pp. and 27 plates.) London: Baillière, Tindall & Cox, 1923, 5s. [63.61(02).]
- Seale-Hayne Agricultural College.*—Pamphlet 9:—Feeding Potatoes to Pigs. (7 pp.) Newton Abbot, 1923, 6d. [63.64: 043.]
- Mississippi Agricultural Experiment Station.*—Bulletin 218:—Grazing and Feeding Trials with Hogs. (32 pp.) A. & M. College, Miss., 1923. [63.64: 043.]

**Dairying.**

- National Institute for Research in Dairying.*—The Feeding of Dairy Cows by J. Mackintosh. (56 pp.) Reading, 1923, 1s. [63.711(04).]
- U.S. Department of Agriculture.*—Farmers' Bulletin 1342:—Dairy Barn Construction. (22 pp.) Washington, 1923. [63.6: 69.]
- U.S. Department of Agriculture.*—Bulletin 1208:—Effect of Feeding Turnips on the Flavor and Odor of Milk. (7 pp.) Washington, 1923. [63.719.]
- U.S. Department of Agriculture.*—Bulletin 1190:—Effect of Feeding Green Alfalfa and Green Corn on Flavor and Odor of Milk. (12 pp.) Washington, 1923. [63.719.]
- Wisconsin Agricultural Experiment Station.*—Research Bulletin 57:—The Fishy Flavour in Butter. (51 pp.) Madison, 1923. [63.726.]
- Seale-Hayne Agricultural College.*—Pamphlet 10:—First Report on the Cost of Food in Milk Production in Devon and Cornwall during the five months November, 1922, to March, 1923. (10 pp.) Newton Abbot, 1923, 6d. [63.714(04).]

**Poultry.**

- Gray, H.*—Poultry Diseases and How to Prevent or Cure Them. (138 pp.) London: "Bazaar, Exchange and Mart," 1923, 2s. net. [619.5.]
- U.S. Department of Agriculture.*—Farmers' Bulletin 1333: Natural and Artificial Incubation of Hens' Eggs. (18 pp.) Washington, 1923. [63.65(041).]













